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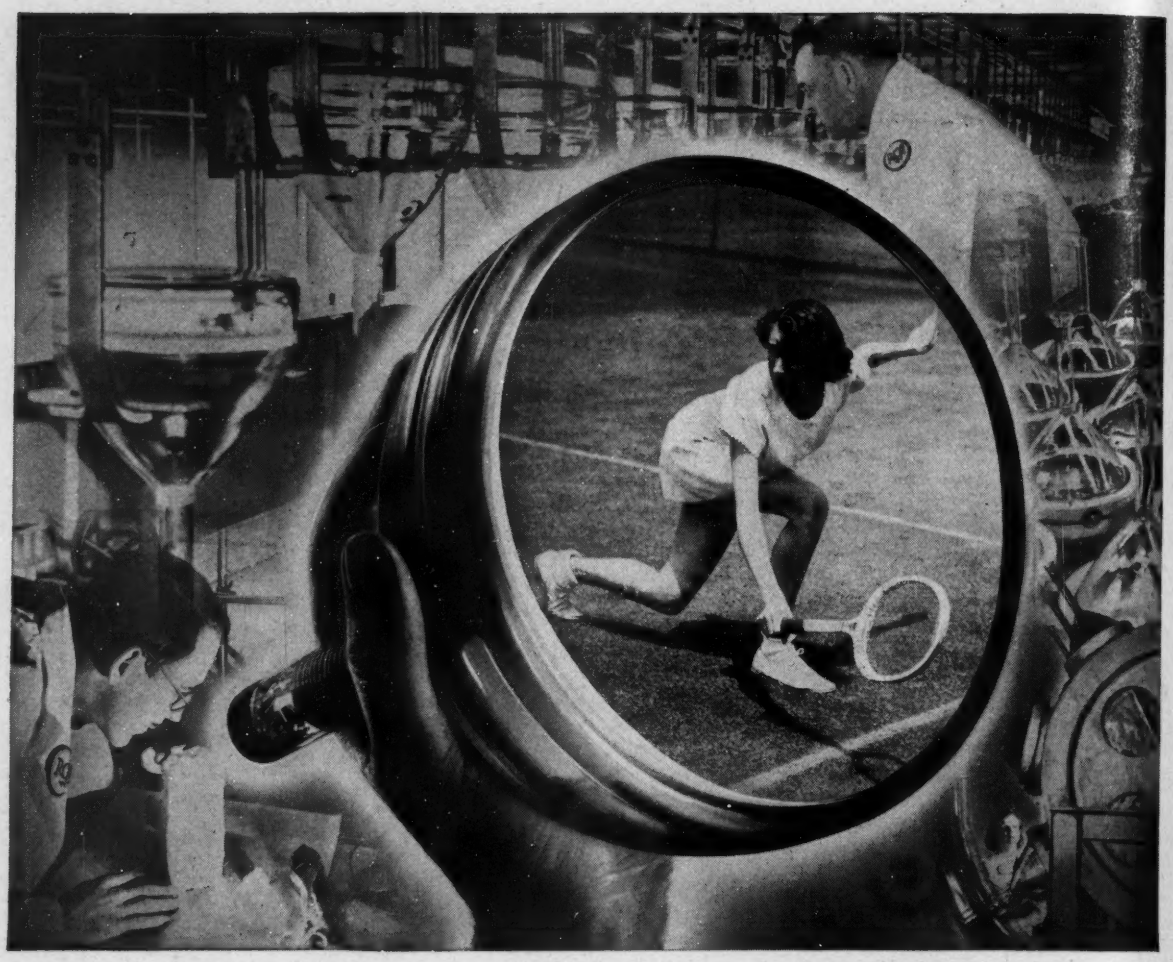

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This issue, October, 1948.

Mechanizers of the Plowshare and Pruning Hook

By PROFESSOR ORVAL C. FRENCH

AGRICULTURE is the oldest and also the largest of the industries. While not recognized as such, agricultural engineering began with the development of the first crude plow. However, as an official organization, the American Society of Agricultural Engineers came into being in December, 1907, so it is one of the latest recognized branches of the engineering profession. The first B.S. degree in Agricultural Engineering was conferred in 1910. Now over thirty colleges in the United States give instruction leading to the B.S. in Agricultural Engineering or its equivalent.

Agricultural engineering deals with the application of the fundamental branches of engineering—mechanical, electrical, chemical, civil—to the specific conditions and requirements of agriculture as an industry and as a field of applied science.

As the name implies, an agricultural engineer must first of all be trained in engineering fundamentals. Since the field is so broad, the ideal curriculum would include all of the branches of engineering sciences. Obviously, time does not permit such extensive training; hence, students must select particular phases of agricultural engineering in which they are most interested. Distinct phases of this profession are broadly classified as:

(1) Farm Power and Machinery,
(2) Rural Electrification,
(3) Farm Structures,
(4) Soil and Water Conservation and Management.

In addition to the fundamental engineering training, an agricultural engineer must have an understanding of the biological sciences (botany, soils, plant science), not that he will also be a specialist in these fields but he must understand and appreciate some of the fundamentals of agriculture, with which he is concerned. Agricultural experience gained by growing up on a farm is not necessarily a prerequisite but it is surely a valuable factor in an agricultural engineer's fundamental training.

For those unfamiliar with the opportunities and responsibilities of an agricultural engineer, let us take a hasty survey of the field:

Farm Power and Machinery

Agriculture is becoming more and more mechanized. Practically every farm enterprise involves engineering applications. Farm power requirements prior to the past war, amounted to 97 million horsepower compared to 50 million horsepower

"Agriculture is the oldest and also the largest of the industries," the first crude plow having initiated the development of agricultural engineering.

THE AUTHOR

Professor Orval C. French is head of the agricultural engineering department at Cornell. He came to Cornell in September of 1947 from the University of California, Davis, California, where he was associate professor of agricultural engineering. He graduated from Kansas State College with the degree of B.S. in Agricultural Engineering in 1930 and received his M.S. degree in 1931.

In August, 1931, he joined the Faculty of the University of California and served there continuously until coming to Cornell, with the exception of three years during the War, when he was on leave to the University of California Radiation Laboratory. Professor French is a member of Sigma Xi, Gamma Sigma Delta, American Society of Agricultural Engineers, and American Society of Engineering Education.

Orval C. French

for industry. Farmers purchase nearly 1 billion dollars worth of machinery and equipment annually. Agriculture is the petroleum industry's largest customer. Tractors are, of course, of major interest to farmers and engineers but so, too, is electrical power. Transmission lines provide power for more than 3½ million individual farms, each with many applications of electrical energy, as power, heat, and radiation.

Machinery is the means of applying this power. It includes tillage equipment for preparing land for crop production, hay harvesting machines, harvesting and threshing of many kinds of seeds and grains, and pest control machinery for fruit and vegetable production. It involves processing equipment for livestock feeds. Human food processing is now a major American industry. This latter field involves food preparation, canning, freezing, drying, and storage; thus chemical engineering applications are called for.

Rural Electrification

Compared with the present cost of electrical energy, the labor of a man is worth about three cents per day. It is small wonder that farmers are taking advantage of electrical power wherever possible, and new uses are being developed daily. About 94 per cent of farms in New York State are electrified from transmission lines, and the annual use of electrical energy has doubled in New York during the past six years. The use of electrical energy in the form of heat including radiant heat, has many farm applications which have scarcely been touched. Much remains to be developed in the use of light and radiation for agricultural applications.

A modern dairy barn—the home of New York's most important agricultural enterprise. Efficient structures require sound engineering design and careful planning.

Farm Structures

The field of farm structures involves dwelling, barns, poultry houses, grain storages, silos, and fruit and vegetable storages, including refrigerated, heated and air conditioned structures. Over ¾ billion dollars are expended annually for farm building materials.

Farm structures need to be designed not only to be structurally sound but also to be functionally correct. The field of "methods engineering" comes into play here because it is vital that work be simplified and labor costs reduced. New York farmers are particularly concerned with dairy barns, poultry houses, and fruit and vegetable storages.

Soil and Water Conservation and Management

Since soil and water are our greatest natural resources, it is imperative that they be conserved and managed properly if we are to maintain our increasing population at its present standard of living.

This field of activity involves the engineering application of hydraulics, hydrology, surveying, and soil physics—all primarily civil engineering specialties, but with different applications than ordinarily thought of by the civil engineers. Irrigation and drainage, along with erosion control and soil building practices, are tremendously important and intriguing fields of endeavor.

Agricultural Engineering at Cornell

The Agricultural Engineering Department is one of the several departments of the New York State College of Agriculture. It is organized to render three distinct, yet interrelated services, namely: (1) Teaching, (2) Extension service, and (3) Research.

The undergraduate instruction program, at present is primarily service courses for College of Agriculture students wishing to gain knowledge and skills in the fields of farm structures, farm machinery, farm power, farm electricity, farm surveying, drainage and irrigation, and farm shop and welding. Students electing to specialize in agricultural engineering are College of Agriculture students and receive their degree in Agriculture, not Engineering. During the past year approximately 550 students were enrolled in agricultural engineering courses each semester.

In addition to the undergraduate instruction a limited number of graduate students are taking their major in this department. *Engineering* graduates are given preference for the graduate positions.

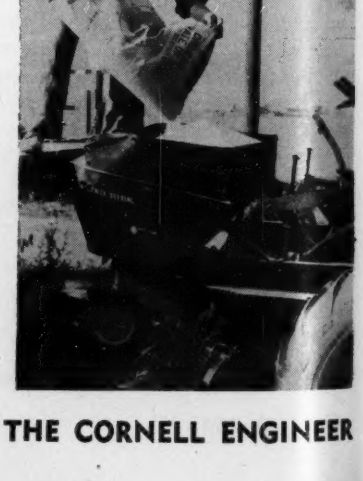
Plans are being developed to offer a professional curriculum leading to a B.S. in Agricultural Engineering. Such a program will be a joint undertaking between the College of Agriculture and the College of Engineering. It is not yet determined whether this curriculum will require five or six years to complete. The realization of this program must await completion of new building facilities since the existing space is taxed to capacity with the present teaching schedules. Plans for a new building are virtually completed, but it is undetermined, at the moment, when construction may begin.

Extension teaching is a major program of the department. It is conducted by four full time extension agricultural engineering specialists and ten district agricultural engineers located out in the state.

This program is designed to assist farmers, farm organizations, and some of the smaller agricultural industries in their problems involv-

Sodium nitrate being poured into a wheel type lime sower for distribuion on a spinach crop. The sower, which has been redesigned to mount on the rear of a tractor, may also be used for sowing clover cover crop.

—Photo courtesy Seabrook Farms



ing engineering advice and solution.

One specialist spends full time on 4-H club activities with the farm boys and girls involved in agricultural engineering applications.

An equally important and essential program of the department is that of *research*. Although severely handicapped by laboratory space limitations, a modest research program is being carried on. A partial list of experiment station research projects under way are as follows: (1) Basic problems connected with removal of hay, (2) study of dairy stable ventilation systems using electric fans, (3) design and layout of poultry laying pens and related equipment, (4) basic requirements and design principles of mechanical equipment, (5) exposure tests of outside paints, (6) development of equipment for application of insecticides and fungicides, and (7) comparison of different placement of fertilizers for vegetable crops.

The opportunities for sound engineering research in agriculture are practically limitless. Most of the problems in agricultural engineering research involve cooperation with specialists of other subject matter fields, so the endeavor involves team work more than individual action. This policy develops road experience and practicability on the part of research workers. An active research program provides new subject matter for the teaching as well as the extension program.

The self-propelled combine with pick-up attachment provides an improved method of windrow harvesting. It circumnavigates coulees and gullies without back-swath to save grain and seed.

—Courtesy International Harvester Co.

Opportunities

Fields for employment of agricultural engineers are many and varied. A shortage of trained men has existed for several years in the various state educational institutions for positions in teaching, extension service, and research. Other public research agencies such as the United States Department of Agriculture, the Soil Conservation Service, and foreign governments have many openings for agricultural engineers.

Another large group of agricultural engineers is employed by industries which serve agriculture, notably the farm equipment industry. Companies that supply building materials, fencing, structures, and processing equipment are taking an increasing number of ag engineers. Electric power companies and equipment manufacturers engaged in rural electrification work are also using agricultural engineers.

More and more agricultural engineers are being employed by banks, trust companies, and insurance companies for appraisal, rehabilitation, and management operations. The food canning companies, sugar companies, and other large-scale agricultural enterprises are using an increasing number of agricultural engineers in their research and production activities.

Engineering Responsibilities

It is unnecessary to point out the many changes which have taken place in agriculture because of the application of science and engineering during the past decade. Census figures show that only about 18 percent of our nation's population is rural, yet the records of farm production during the past seven years prove that mechanized agriculture has met the tremendous demands for food that have been made by this and other nations.

The farmer has accepted the responsibility of producing products of the soil beyond his own needs. This responsibility carries with it the obligation to provide these products at reasonable costs, and, at the same time, the farmer is deserving of reasonable profits.

Agricultural engineering has a vital role to perform in helping farmers meet these responsibilties. The use of proper equipment will determine in large part the profitableness of any present day farm operation. Proper land use must be based upon agronomy and soil technology, but it is the engineer who must develop means of making its use profitable. It is the foremost responsibility of the agricultural engineer to develop increased farm efficiency if we are to maintain our existing nutrition and economic standards of living.

A NEW ERA
FOR CASEY JONES

The Turbine Locomotive

By HOWARD KALTBAUM, ME '51

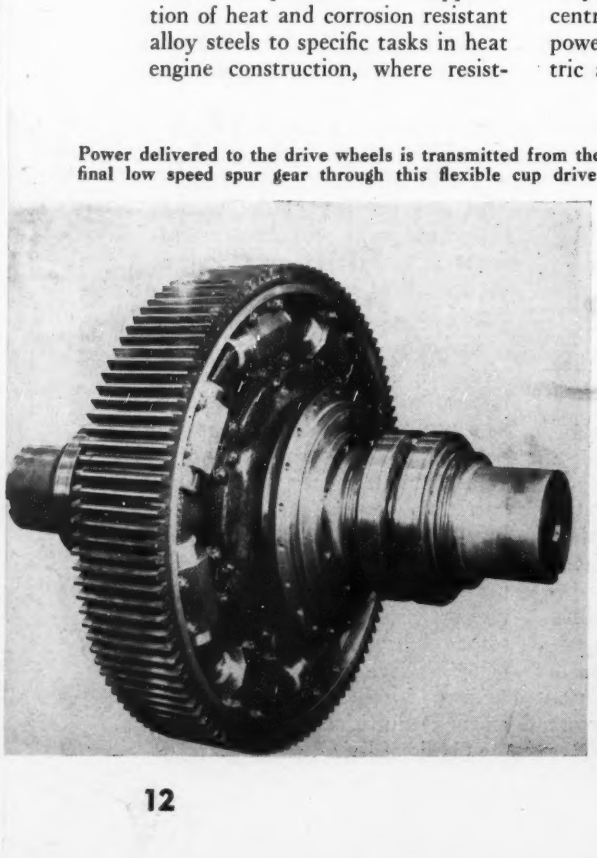
Photographs courtesy Westinghouse Electric Corp.

This article was the basis of Howard Kaltbaum's entry in the 1948 technical speaking contest sponsored by the Cornell student branch of the American Society of Mechanical Engineers. The resulting speech won first prize here at Cornell and also took fifth place honors at the 1948 regional student conference of the American Society of Mechanical Engineers at Lehigh University.

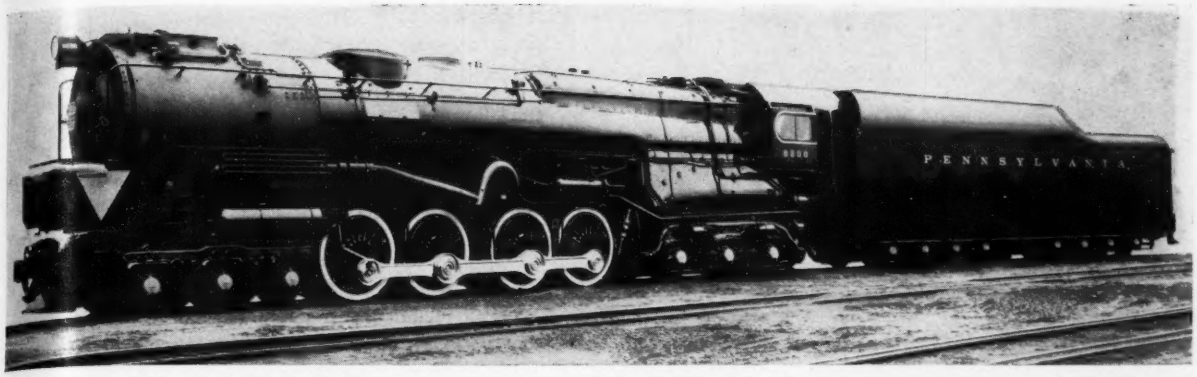
STEAM prime movers for railway locomotion have not changed essentially for well over a hundred years. Such a record is significant evidence attesting to their durability and satisfactory performance under prevailing operating conditions. Today however, because of rapid advances in the metallurgical field, the designer of steam engines is permitted the freedom of working with a far greater range of temperature and pressure conditions than was heretofore possible. The application of heat and corrosion resistant alloy steels to specific tasks in heat engine construction, where resistance to extreme conditions of temperature and pressure in the design of steam turbines. That the steam turbine should eventually replace the reciprocating steam engine for railway use may be expected. The turbine has already very successfully replaced reciprocating steam in central power stations, industrial power plans, and marine turboelectric and geared turbine propulsion units. The gratifying results experienced here apply equally well to the geared turbine locomotive.

The turbine drive was first applied to railway use in 1933, when a two thousand horsepower unit was employed by the London, Midland, and Scottish Railway Co. This relatively small unit operated on the main line between London and Glasgow quite satisfactorily, from an engineering point of view. However, it did not indicate conclusively that it was more economical than the compound reciprocating engine used in England at the time. The situation in the United

Power delivered to the drive wheels is transmitted from the final low speed spur gear through this flexible cup drive.



The entire driving unit with the turbines removed, showing the double reduction gear unit nested between the second and third driving wheels.



It is at high speeds that the geared turbine locomotive asserts its superiority. Sufficient data have been compiled in the 60,000 miles this 6,550 horsepower unit has been operated to determine comparative merits with the conventional steam and the Diesel-Electric locomotive.

States is quite different. The trend in America is towards larger trains both for passenger service and fast freight. It is in the range of larger units that the geared turbine is able to assert a distinct superiority.

Recently, the Pennsylvania Railroad has placed in service a 6550 hosepower turbine locomotive which was the result of a joint undertaking of the Baldwin Locomotive Works, Westinghouse Electric Co., and the Pennsylvania Railroad. To date, this unit has operated for approximately 60,000 miles between Chicago and Crestline, at the head of the Pennsylvania's fastest trains. Sufficient performance data have been compiled to determine the relative merits of this unit, as compared to the conventional reciprocating steam and the Diesel-Electric locomotive.

At high speeds the geared turbine locomotive stands alone with respect to fuel savings and its economical use of steam. The unit reaches its maximum thermal efficiency at 70 miles per hour, at which time it requires just under 15 lbs. of steam per horsepower delivered at the rail, while the reciprocating type engine requires better than 17 lbs. of steam to perform the same task.

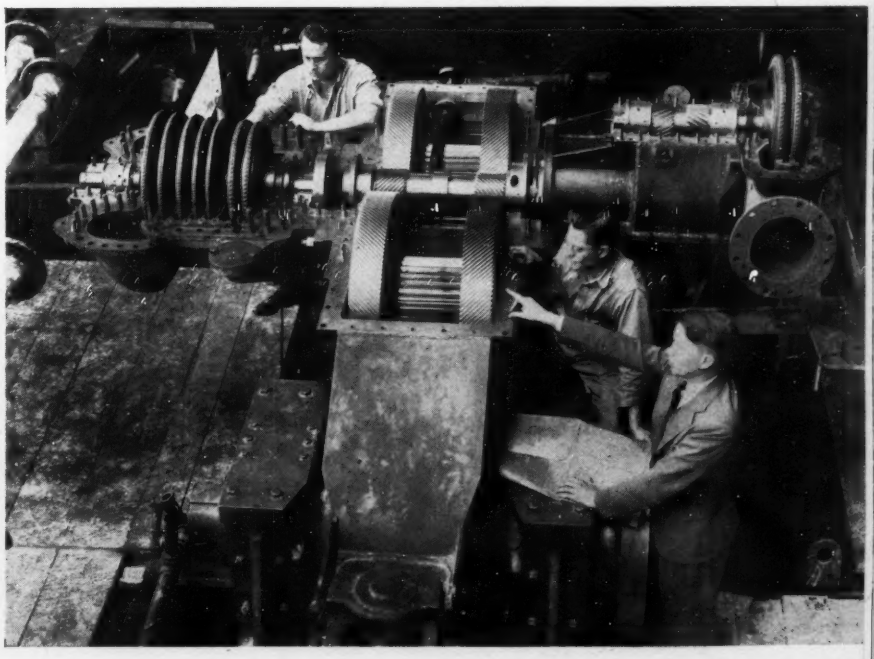
Tractive Forces Compared

A comparison of the tractive force developed by the three types has been made. A Diesel-Electric engine of 6000 horsepower, the largest unit built to date, shows superior tractive force at low speeds due to its electric transmission which produces a high starting torque. In the range of normal and high operating speeds, however, the greater tractive effort of the geared turbine locomotive is clearly evident. Improved tractive effort is developed by the turbine when compared to the reciprocating engine over the entire operating range. The data for the conventional reciprocating engine was compared on the basis of equal amounts of steam delivered to both the turbine and reciprocating engine from boilers of equal capacities.

Data has been plotted to indicate the relative horsepower developed by the three types of locomotives at various operating speeds. The turbine locomotive developed its maximum horsepower of 6550 at 70 miles per hour, while the other units developed a maximum at lower speeds. With increased speed as an added attraction, the turbine drive will most certainly meet with the approval of passengers as well as freight shippers. The importance of higher horsepower is made more apparent in locomotives, when one considers the fact that with a seventy-five car (3750 tons) load of freight being hauled at 70 miles per hour, approximately 7400 horsepower is required, while 9600 horsepower is required to pull a hundred

(*Continued on page* 34)

Assembled driving unit with the gear case cover removed, showing the forward turbine at left and the reversing turbine at right. Both turbine units are bolted to the compound reduction gear unit in the center of the photo.



ACHROMATIC TELEVISION WILL BE HERE FOR A WHILE, BUT . . .

Color Video Is On The Way

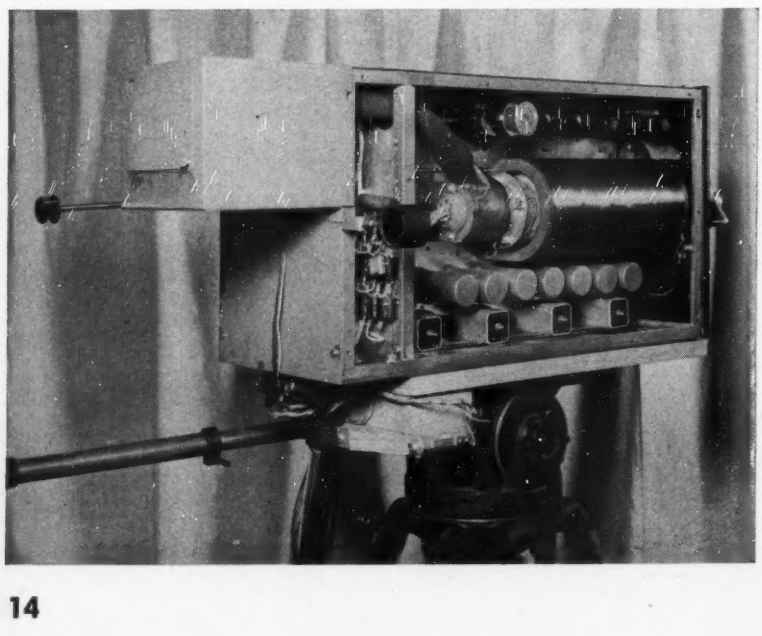
By LYNN W. ELLIS, JR., E.E. '48

Photographs courtesy the "RCA Review"

SINCE the hearings by the Federal Communications Commission on color television late in 1946, when the FCC decided to deny commercial status to color, there has been a rush to publish material on the two rival systems of color television thus far proposed: the sequential color system championed by CBS, and the simultaneous color system proposed by RCA. Also since then, both sides have done considerable research into the weak points of their respective systems, which data is as yet unpublished.

The eventual aim of color television is to produce a picture that will have comparable qualities to present "Technicolor" movies, at a suitable light level for home viewing. Studies have indicated that the first goal should be a picture of *actual* resolution and repetition rate of that of monochrome standards, but in color, the color to be a mixture of three primary colors —red, green, and blue. This would theoretically require three times the bandwidth over a similar transmission system, according to Hartley's principle of communication. The sequential system accomplishes this by transmitting three one color frames, with suitable color filters on a rotating disc, one after the other in the time of one full picture. These are transmitted on the same communication channel, and recombined by means of a rotating disc of color filters at the receiving end through one reception device. The simultaneous system uses three separate single color channels to achieve the same result, but must have three pickup devices and three receptors whose pictures must then be combined optically. Because of wide bandwidth, both systems must use higher frequency carriers than monochrome—probably in the 500-900 mc range.

Used for direct pickup of studio and outdoor scenes with illumination levels varying from 150 to 300 foot-candles, this RCA sequential color camera has a special form of image orthicon incorporated in the color system.



Systems and Standards

To understand fully the proposed color systems, we must compare them with black and white standards as set by the FCC. The picture repetition rate on any television system, or in the movies, must be greater than about 30 pictures per second for low levels of illumination and correspondingly higher for higher levels of illumination, in order that the eye shall not see flicker. The movies many years ago were standardized on 24 pictures per second film speed, but show each picture twice for a total of 48 pictures per second. Because of synchronizing difficulties, black and white television standards have been set at 30 pictures per second, or with interlacing, 60 frames per second, which is exactly the a.c. power system frequency. For each picture there are 525 scanning lines, giving a resolution of black and white of 300-400 lines, depending on signal to noise ratio.

Two experimental sequential systems have been produced, one by CBS, which has operated since

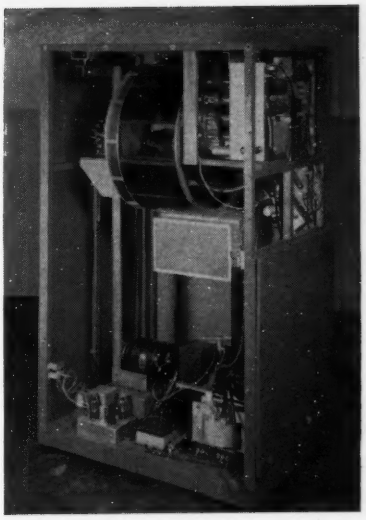
1942, and one by RCA, since 1946. Both systems use 525 lines, and a 20 picture per second rate of three colors interlaced or 120 fields per second, but the proposal sponsored by CBS at the FCC hearing was for a 24 picture per second rate. Much more complicated synchronizing equipment will be required for this, but from a production standpoint, standards the same as the movie industry would be greatly desired. Both used a time-multiplexed frequency-modulated sound, inserted on the television carrier during the latter half of the blanking pulses. However, the upper limit of audio fidelity is 10 kc, as compared with the FCC monochrome standards of 15 kc, due to the inherent characteristics of the system. CBS states that actual resolution is approximately that of black and white (no figures given), while RCA gives a figure of 250 lines, somewhat below that of black and white. The slower picture repetition rate gives a theoretical increase in resolution, according to Hartley's principle, but this is counter-balanced by an increase in noise due to increased bandwidth. Also, to be considered in this comparison is the apparent (subjective) increase in resolution due to color, variously given as 2⅓ to 2½ times.

One of the primary advantages of this system is that it has been thoroughly field tested by CBS for six years, and a good many of the difficulties have been ironed out. Also, with the present limited number of wide band circuits, the utility of the system on bandwidths as low as 3 mc, less than one half that of the standard for black and white, is greatly to be desired. CBS engineers have shown that from an *audience* point of view, sequential color over a 3 mc circuit is better than black and white. The primary disadvantage is the same as that for the scanning disc type of black and white—the flexibility of an electronic system will eventually surpass that of many mechanical ones. Two other disadvantages dealing with light efficiency will be discussed along with the simultaneous system.

Simultaneous System

The simultaneous system, of which only RCA's version has been operated, uses an entirely different method that completely does away with mechanical scanning devices. By separating and recombining red, green, and blue components optically and transmitting them on three different channels, certain further advantages can be realized. One of these is that by simultaneous transmission of the three color components, a 3 to 1 increase in signal to noise ratio (for the same bandwidth) can be realized by this system over the sequential "one at a time" system. Furthermore, to separate the components at the pickup camera, a device known as a dichroic reflector can be used which reflects only light of one color and passes all others. Extremely satisfactory dichroic reflectors have been made for red and blue, which give 98% total efficiency as compared with the 40-50% (for one color only) of conventional color filters. These two factors alone give a 6 to 1 or better increase in signal to noise ratio for this system over the sequential.

Another useful modification of the simultaneous system is to limit the blue band to 1.3 mc (video), instead of the 4.0 mc as for red and green, and present day monochrome. It has been shown that while this decreases the absolute resolution slightly, the net result is almost the same as for a 4.0 mc blue band, in the final picture. RCA engineers are not clear as to the reason for this effect, but it seems to be due to increased resolvability at the shorter wavelength of blue light, combined with the response characteristics of the eye.



Drum receivers provide a good view for large audiences. Twelve rectangular color filter sections of red, blue, and green form the periphery of the drum, which is rotated at 600 rpm.

Using these modifications, the RCA system used 525 lines, video bandwidths of red—4.0 mc, green—4.0 mc, and blue—1.3 mc, and a 30 picture per second (interlaced) rate, again providing simple synchronism with the power lines. The total bandwidth was 14.5 mc, and two arrangements of the components on the frequency spectrum were used. The first used green on the low end of the band, then blue and red, and the second used green and red reversed from the first. Although the second system provides for a somewhat reduced bandwidth, this is not expected to be important when color finally becomes a commercial reality, and since with the first system it is possible to use subcarriers for the red and blue components, the decrease in initial and operation cost at the studio makes it preferable.

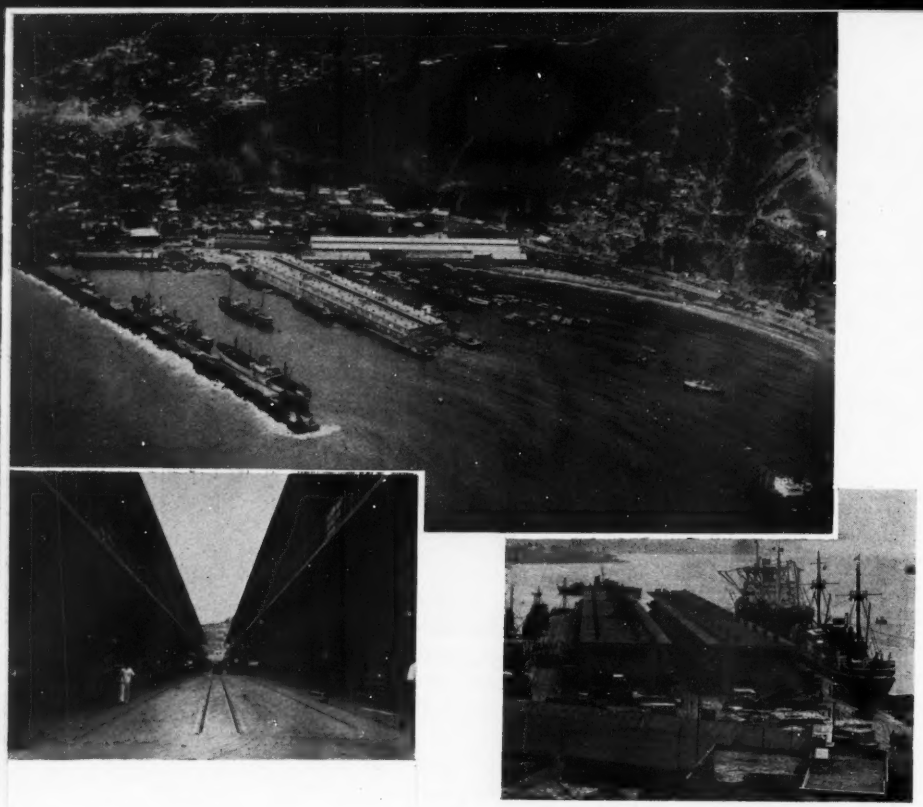
Both variations use synchronizing signals on the green carrier and sound, in the same relation to the green carrier as in black and white (the sound itself may be either a

(*Continued on page* 42)

THE AUTHOR

Born at San Mateo, California, Lynn W. Ellis, Jr., graduated from Staples High School in Westport, Connecticut. He came to Cornell in 1944, and received the degree of Bachelor of Electrical Engineering in June 1948, graduating first in his class.

While at Cornell, he was on the swimming and rifle teams, and was active in Phi Kappa Phi, Alpha Phi Omego, Scabbard and Blade, and the Cornell Radio Guild. He is an associate member of A.I.E.E. and the Institute of Radio Engineers, and earned a commission in the Signal Reserve as second lieutenant through the R.O.T.C. Mr. Ellis is now employed as a junior engineer with the Federal Telecommunications Laboratories in Nutley, New Jersey.



The concrete pier at La Guaira, Venezuela, completed by Raymond Pile in 1945 and views of adjacent terrain. This pier, which substantially increased the freight handling capacity of the port, is 1,070 feet long by 237 feet wide. It supports 2 two-story concrete warehouses, each 840 feet long by 45 feet wide.

Profile--

Maxwell M. Upson, M.E. '99

By LEON H. A. WEAVER

Editor, *The Raymond Record*

Photographs courtesy "The Raymond Record"

During his more than forty years association with the Raymond Concrete Pile Company, Maxwell Maynew Upson has gained a reputation as one of the foremost construction engineers in the country. Among the many contributions he has made to the industry have been the introduction of the use of reinforced concrete in the construction of large industrial plants and the development of the proper procedure for building underwater structures such as pilings for piers, retaining walls, and seawalls. At the present, Mr. Upson is serving in the capacity of Chairman of the Board of the Raymond Company and is devoting a great measure of his efforts to guiding the activities of the concern, which have grown by this time to include not only operations on a domestic scale but heavy construction in industry throughout the world.

A son of the Middle West, Mr. Upson was born in Milwaukee and moved shortly thereafter with his parents to a farm in North Dakota. He received his early education in Grand Forks and after graduation matriculated at the University of North Dakota. While an undergraduate there, he was quite active on campus, serving as an officer in the cadet corps, as captain of the baseball team, and as manager of the student paper. His B.A. degree was forthcoming in 1896, following which he entered Cornell University, having decided by this time to make engineering his career. The choice was well-founded for he had all his youth shown a definite mechanical know-how. He had been especially interested in farm machinery and its operation and had even held a license at 17 as a steam boiler engineer. At Cornell, Upson was an important member of the class of '99, serving as business manager of the *Sibley Journal* (predecessor of the CORNELL ENGINEER) and as president of his senior class. He was a member of both Aleph Samach and Sphinx Head during that time.

Maxwell M. Upson

After receiving his B.M.E., Mr. Upson accepted a position as a field superintendent for Westinghouse, Church, Kerr, and Company, engineers and contractors, specializing in power-house and industrial plant design and construction in various parts of the country. A promotion in 1903 made him one of the company's construction managers with his headquarters in New York —a position which proved invaluable in his advance to a position of prominence. A major milestone in construction history marked this period in his career when he designed and built the first reinforced concrete industrial buildings, the Canadian Westinghouse Plant at Hamilton, Ontario.

Then in 1905 he entered the employ of the Hockanum Mills Company of Rockville, Conn., as chief engineer and assistant to the president. During the two years he spent with this firm, he was responsible for the development of the first all-reinforced concrete textile mills. The theory previous to this time had been that the excessive vibration caused by such a mill would shake the concrete loose from the steel; however, Upson's position was vindicated in that his new mill held up and proved highly successful.

The idea of the Raymond cast-in-place concrete pile had been proved sound by many successful installations but there was no one within the organization who had the necessary business and technical background to solve the many problems that confronted the concern. At this point, Mr. Upson came in as general manager and chief engineer, and under his policy of specializing in one or two phases of the construction industry, Raymond grew to become internationally recognized as a leader in all types of foundation work and heavy construction.

Among the jobs that have been handled through Raymond Concrete Pile Company have been the managing of the huge Pacific naval bases construction program at Pearl Harbor, Wake, Midway, etc., during the past war; the construction of the harbor at Monrovia, Liberia, which involved building two heavy,

(*Concluded on page* 32)

Dean Hollister's

Greetings to the Class of '53

It is a pleasure to welcome you to Cornell as members of the Class of 1953 in Engineering.

Dean S. C. Hollister

As you know, it has been possible for us to accept only a limited number of all those who have applied for admission to Cornell. The fact that you are here is indicative of a confidence on our part that you have the type of academic ability and personal aptitudes upon which a successful career in engineering can be built. Our whole purpose here is to work with you toward the development of the knowledge, the judgment, and the breadth of intellectual interest that will shape your future. This we offer to all of you without favor, but it is for each of you individually to determine, through your own application and strength of purpose, the extent to which you will gain from all that is here for you.

In effect, you are now entering the profession of engineering and your record from this point forward will have a bearing upon your future in the profession. Even though you have a distant goal in mind, it is important to realize that ultimate achievement is the summation of your progress, day by day. Each day's work well done cannot help but bring success.

Many of those who have been here before you have gone onward to distinction as engineers and citizens. It is my great wish that each of you may find in these years at Cornell the path to a bright future.

I congratulate you on the opportunity that is before you. The College and its Faculty will watch your progress with warm interest and will help in every way to assist you to achieve a full measure of success.

S. C. HOLLISTER, *Dean*
College of Engineering

Site of Lillian Wald publicly financed low-rent housing project in New York City's East Side. More than 6,000 Raymond step-taper and and pipe step-taper piles are being placed in the foundations for 16 buildings 10 to 14 stories high. At rear are partially completed Jacob Riis homes.

Recent Developments In Engineering

Techni-Briefs

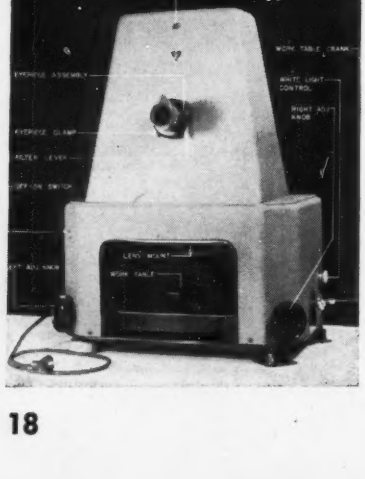
Wobble Eradicator

Furniture wobble, that universal bane of every household, may soon be a thing of the past. Blake Industries of Detroit has developed a device known as "Levelmatic," which incorporates General Electric bouncing putty in a simple cylinder and piston arrangement that will automatically adjust table leg lengths. Floor variations up to three-sixteenths of an inch can be accommodated and the product is capable of supporting the weight of a piano for an indefinite length of time.

Flatness Measured

A new type interferometer for measuring flatness of surfaces has been designed by Dr. W. Ewart Williams of Pasadena, California, consultant to the Bausch and Lomb Optical Company. Unlike previous model interferometers, the new instrument can be used at various room temperatures and can be operated by anyone after only a few minutes instruction.

Greatly simplified in operation, this new type interferometer readily measures surface flatness.
—Photo courtesy Bausch & Lomb



Also the new device is dissimilar to the usual type interferometer in that its master optical flat (the standard test glass used for measuring flatness of surfaces) is never brought in contact with the object under inspection, so the possibility of its being scratched, worn out, or distorted is eliminated. Instead, the machine sets up interference bands in light reflected between its master optical flat and the object being tested.

Field of view of the large model Williams Plano Interferometer is four and one-quarter inches in diameter. Its surface accuracy is one-millionth of an inch.

Leakage Detector

Minute leaks in pressure systems can be detected by means of a pistol-shaped electronic device developed by General Electric Co. When directed at the outside wall of a system, the "gun" sucks in a stream of air in which it can register freon gas leakage at the rate of one hundredth of an ounce a year.

The detector operates on a principle which is exactly opposite to that of an electron tube, since it utilizes the principle that certain metals, when brought to red heat in air, emit positive ions, instead of negative electrons emitted by the cathode of an electron tube. These positive ions pass from the anode to a cold cathode, and when even small amounts of vapors of the halogens or their compounds strike the anode, this current is increased markedly. With its electronic control unit, the instrument is thus useful for recording the presence of fluorine, chlorine, bromine, and iodine and their compounds such as carbon tetrachloride, chloroform, methyl chloride, methyl bromide, hydrochloric acid, and freon. These gases can thus be used as "tracers" in systems which are to be tested by the instrument.

Electron Paths Traced

Eastman Kodak Company has developed a new photographic emulsion which is sensitive enough to record tracks of individual electrons. It is believed to be the first emulsion to provide definite identification of the tracks. Each electron is said to develop six to twenty-eight silver grains, in a track about two thousandths of an inch long. This permits scientists to determine the direction and speed of the electron, and thus the position and character of its source. Such information is very valuable for studies of atomic disintegration, in cosmic-ray research, and in medical research involving use of radioactive elements as "tracers." The emulsion is made of very fine grains of equal sensitivity to record individual tracks rather than overall radiation density.

Magnetic Sealing

A plastic sealing sleeve has been developed to insulate magnetic coils. This process permits the covering of all inner and outer surfaces in one operation by slipping inside the magnetic coil a sealing sleeve, turning the two ends over the outside and permitting the sleeve to air dry.

In preparing the sleeves, the plastic is immersed in a special solution for several hours. When the plastic has expanded to one and a

(Concluded on page 50)

News of the College

Permanent C.E. Director

Dr. Nephi Albert Christensen has been appointed director of the School of Civil Engineering, succeeding Professor Carl Crandall, acting director. Dr. Christensen assumed his position on September 1. He was formerly dean of engineering at Colorado State College.

Director Christensen

Dr. Christensen, 45, is a native of Provo, Utah. He was graduated from Brigham Young University in 1925, took his B.S. in civil engineering at University of Wisconsin in 1928 and obtained his M.S. and Ph.D. degrees in 1934 and 1938, respectively, at the California Institute of Technology.

He served as a highway engineer with the Wisconsin State Highway Commission and from 1928-33 was a professor of exact sciences at Ricks College in Idaho. He was an assistant engineer in the Cooperative Laboratory of the California Institute of Technology Soil Conservation Service, 1934-38, and in 1938 was a special lecturer at the University of Southern California. During this period, he also carried out hydraulic model research on spillway design for the Roosevelt Dam and other western dams.

Since 1938 he has been dean of engineering at Colorado State College and chairman of the engineering division of the Colorado Agricultural Experiment Station. On leave during 1942-45, he served successively as chief engineer of the Ballistics Research Laboratory and chief of the research branch of the Rocket Research Division at the Ordnance Research and Development Center, Aberdeen, Md.

Ad Survey Results

The CORNELL ENGINEER staff would like to express its thanks for your cooperation in our recent advertising survey. A total of 1492 replies shows a better than average concern in the magazine and its advertising. Since we feel that you may be interested in the proportion of ENGINEER readers in your field, here is a nearly complete tabulation of the results obtained.

Question: In what field did you receive your degree?

M.E.	771
C.E.	422
E.E.	234
Ch.E	65

Question: In what field are you now engaged?

Engineering	955
Relative Fields	388
Other Business	149

Question: List the industries in which you work or have business contacts or interests, or whose product you use.

Steel Products	711
Electrical Products	591
Utilities	521
Petroleum Products	591
Foundry Products	361
Chemical Products	358
Automotive	321
Rubber Products	303
Plastics	267
Technical Books	256
Textiles	156

Dr. Edwin W. Hamlin

Dr. Edwin W. Hamlin, professor of electrical engineering and director of the Cornell University Microwave Astronomy Project, died at his home last April 27. He was 42.

He received his B.S., M.S., and Ph.D. at Union College, where he was subsequently an instructor. From 1935-39, he was successively assistant and associate professor at the University of Kansas, and for the next four year was professor of electrical engineering and director of the electrical engineering research laboratory at the University of Texas.

Dr. Hamlin was a member of the American Institute of Electrical Engineers and the Institute of Radio Engineers. He was serving as secretary of the electrical engineering division of the American

Prof. Edwin W. Hamlin

Society for Engineering Education at the time of his death. Dr. Hamlin was a member of the honorary societies Eta Kappa Nu, Tau Beta Pi, and Sigma Xi. In 1925-26 while an undergraduate at Union College, he won the Charles P. Steinmetz honor award.

Dr. Hamlin joined the Cornell

(*Concluded on page 28*)

The Editor's COLUMN

A Message To Freshmen

WELCOME TO CORNELL. In the next few weeks those of you who are freshmen will hear those words in one form or another many times. The CORNELL ENGINEER is happy to extend its greetings to you and hopes that your stay in Ithaca will be a success and a pleasure.

Words of advice to freshmen are no novelty, but that is no reason why they should not be heeded. Therefore, at the risk of seeming repetitious, the ENGINEER would like to offer some suggestions which may prove valuable in starting your college career.

First and foremost, of course, is the matter of your studies. If your grades are not satisfactory, you cannot remain in school. For most of you, getting satisfactory grades at first will not be easy. Hard study is necessary, but equally important is the acquisition of good study habits. You will find that the most effective study methods vary with the subject, but that regardless of the method, absolute concentration is the secret. Just remember that the next time you are trying to study with the radio on.

About the time your second round of prelims begins, many of you will find that you are worrying instead of studying. Entire books have been written on the subject of worry and all that can be said here is that it is a waste of time, and the less you do, the better. A certain amount is inevitable, but there is a difference between planning your work and worrying about it.

The importance of adequate recreation cannot be over-emphasized. It is just as necessary as adequate sleep. Do not think that all time spent in extra-curricular activities or at the movies is wasted, for it is not. You will find that you study much better after completely forgetting school work for a while.

As for the subject of extra-cur-

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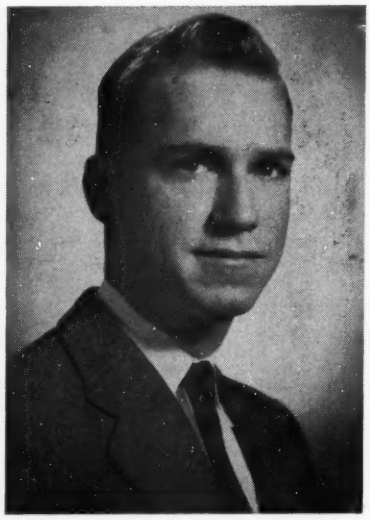
PROMINENT



Joe

Jos. E. Jewett, Jr., ChemE

Catching "Jump'n Joe" Jewett in any place except his "home" on the third floor of Olin where senior ChemE's carry on their research projects is something of an impossibility for one not possessed of seven-league boots, but at least we were able to approach him there long enough to get the data for this report.

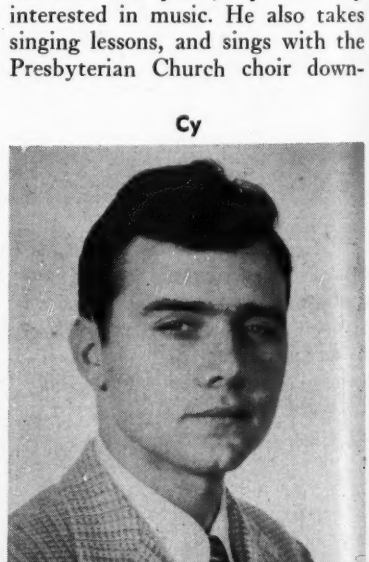
Joe came to Cornell in July, 1943, from Mamaroneck High School with both LeFevre and State Tuition scholarships, and, having served a brief spell in the Navy, is scheduled to graduate from the School of Chemical and Metallurgical Engineering this February. Impressed by the scope and complexity of chemical engineering operations and processes, and encouraged by his Dad's work in the field, he was pointed towards this career from an early age, and already has first-hand acquaintance with many of the large chemical industries in the east. Membership in Tau Beta Pi, honorary engineering fraternity, Pros-Ops, honorary chemical engineering society, and Al Djebar indicate his interest and ability in his work, but his activities are by no means limited to the academic. Starting as a freshman member of the Straight committees as well as the former Frosh Governing Board, he is now on the Board of Managers of Willard Straight Hall, and is also a member of Phi Delta Theta. As an enthusiastic yachtsman he is a Rear Commodore in the Cornell Corninthian Yacht Club and served as regatta chairman last spring.

Joe has fairly definite ideas on what his future in the industry will be, his chief interest being in petroleum engineering; especially in the production end of it. The past summer has seen him gaining experience at the Esso Standard refinery at Baton Rouge, La. Certainly an already dynamic petroleum industry will profit by his addition to its membership.

Silvio C. Volpe, AEME

Can engineering students devote a good part of their interest to one or more of the fine arts, without impairing their interest in engineering? Cy Volpe believes they can, and he has been busily proving this theory while at Cornell. A member of the Men's Glee Club for over two years, Cy is avidly interested in music. He also takes singing lessons, and sings with the Presbyterian Church choir down-

Cy



ENGINEERS

town. This fall Cy intends to form an engineer's barbershop quartet. But, though he spends much of his time on music, Cy's unflagging interest in engineering brings him a consistently high average in the M.E. school. His membership in Tau Beta Pi and Kappa Tau Chi at-

(*Concluded on page* 30)

Paul R. McIsaac, EE

The uncertainties of Ithaca weather are an old story to Paul McIsaac, who has lived here since 1935. In fact, he learned the truth very soon. for the dav after he moved to Ithaca the well-remembered flood of that year struck the town. While in high school he became interested in radio, and upon graduation he received a New York State Cornell Scholarship. Hence, it was only natural that he should register in the EE School at Cornell. Here he has maintained an almost phenomenal scholastic average, but at the same time never neglecting extra-curricular activities.

Paul completed three terms at Cornell before the Navv added him to its growing flock of Radio Technicians. Prior to his discharge he taught in the Navy's electronics course at Navy Pier, Chicago.

Since his return to Cornell in the Fall of 1946, Paul has been elected to Tau Beta Pi, Eta Kappa Nu, and Alpha Epsilon Rho, national honorary radio society. He is a member of the A.I.E.E., the Independent Council, the Westminster Student Society, and of the University Orchestra, in which he plays the French horn. And finally, membership in the Delta Club provides a recreational outlet.

Unfortunately, the EE schedule leaves Paul little time for hobbies, but he manages to keep up with his music and to do a little photography. Recently, he has been applying his mechanical ingenuity to the task of maintaining his car, a '37 Plymouth, which, he claims, seems to be doggedly trying to effect a complete breakdown. Although Paul makes no claims of having superior and discriminating judgment, he does express a preference for Ithaca College co-eds.

Paul spends an average of twenty hours a week at Station WHCU, where he works part time running the control board. During the summer he was employed by Western Electric on carrier test set development.

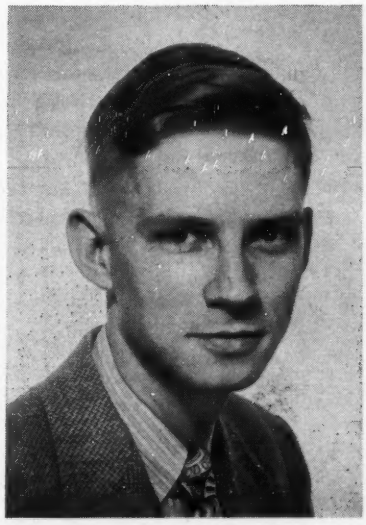
The theortical side of electronics interests Paul, and he has taken electives in the Physics Department. His aim after receiving his B.E.E. in February is research in electronics, and he may do graduate work in this field.

William Mendenhall, CE

Bill Mendenhall saw daylight for the first time in Indianapolis, Indiana, twenty-five years ago. After moving to Chicago, back to Indianapolis again, and to Pittsburgh, his family moved to Ithaca in 1939. Bill attended Mount Hermon School in Massachusetts for two years and entered the C.E. school in 1941.

Enlisting in the Air Corps in his sophomore year, Bill spent three and a half years going the rounds

Paul



Bill

and "doing almost anything." His discharge papers show that he was, among other things, a weather officer, a radio operator, a parachute rigger, and an aerial photographer. "Life was never dull," he says.

Returning to Cornell in 1946, he did some research work in the Physics Department, but in the fall was back in the familiar corridors of Lincoln Hall.

Bill is a member of Tau Beta Pi and Chi Epsilon. He was president of the latter organization last spring. Other campus activities have been freshman track, Pershing Rifles, Freshman Camp counselor, various CURW offices, Lambda Chi Alpha fraternity, and the Cornell Pilot's Club.

Flying is a favorite pastime with Bill, but one which he claims constantly keeps him broke. He has a private flying license and hopes eventually to get a commercial licensc. Amateur radio is another field which has a grip on him. He operates a station W2UTE (you too can "wute") which puts out a powerful 35 watts.

Firmly maintaining that "summer around Ithaca is the only decent part of the year," he stays as far away from the classrooms as possible by working on various construction crews. Last summer he drove to Alaksa to do construction work there.

Bill graduates in February. His plans for the future—"Your guess is as good as mine."

Cornell Society of Engineers

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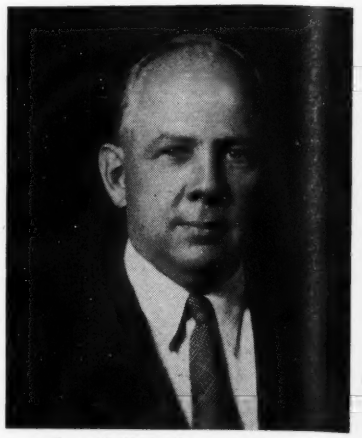


Creed W. Fulton, M.E. '09

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University its graduates and former students and to establish a closer relationship between the college and the alumni."

The Cornell Tradition

As your President I am accorded the privilege of a regular column in the CORNELL ENGINEER.

To be your President is an honor which I sincerely appreciate, but to be a columnist for such a distinguished and critical audience as the CORNELL ENGINEER affords sufficies to disturb my usual calm.

However, I shall try to give you, as best I can, the impressions of a Cornell Engineer of ancient vintage, looking backwards occasionally when it seems worthwhile, but primarily looking at the problems of today, and ahead and up toward the goals to which all Cornell Engineers should aspire.

In my time—the good old days as many of my contemporaries call them—Cornell had achieved within a relatively short time, an honored place in the Engineering world. Cornell's first President, Andrew D. White, then in retirement, graced the campus and inspired us by his presence.

In the Engineering College we still felt the spell of Thurston, Fuertes, Sweet, Durand, Ryan and other now legendary and inspiring leaders.

In classes and at campus social events we saw, listened to, and occasionally argued with such celebrities as Kimball, Carpenter, Church, Diederichs, Hirshfeld, Karapetoff, Dennis, Uncle Pete Smith, and a host of others, indelibly woven into the fabric of Cornell's mantle of leadership. Cornell in those days—as at present—was good. Good to see, good to feel and good to remember when away.

Over the years Cornell has continued to explore and to lead. Cornell Engineers by and large have enjoyed a high regard and acceptance, by the industrial world, which is second to none. This highly desirable condition I believe stems from two sources:

First, from the spirit of Cornell which is, and always has been that of the pioneer, constantly seeking new horizons, exploring new fields, advancing new ideas and developing men of vision, courage, and ability. This Sprit of Cornell has developed a great tradition. Every Cornellian should read the masterful address of Professor Carl Becker, delivered on April 27, 1940, the 75th anniversary of the Charter of the University, on the subject: "The Cornell Tradition: Freedom and Responsibility."

Second, as Professor Becker so aptly pointed out, "From the distinguished achievements of its faculty and the high quality of instruction offered its students, Cornell acquired a reputation which places it among the leading universities of the country.

"In the process of acquiring a reputation Cornell acquired something which is the better part of its reputation.

"It acquired a Character."

This priceless legacy you and I enjoy. Perhaps we have not always recognized its presence, or appreciated its value. But I feel sure that most of us feel closely drawn to Cornell, firmly held by the bonds of Affection, Pride and Conviction.

What we need to do is to create a greater consciousness of the contribution Cornell has made to our lives and to our country. We may have Affection and Pride, but we need more conviction that Cornell has done and is now doing a great job—a job that deserves not

(*Concluded on page* 38)

Alumni News

Professor Alexander S. Langsdorf, M.M.E. '01, A.B. '03, has retired as Dean of the school of engineering and architecture at Washington University, St. Louis, Mo. He joined the faculty there after leaving Cornell and has held positions there since 1929, until his retirement last July.

Carlos B. Mirick, M.E. (E.E.) '05, has retired as special assistant to technical information officer at the Naval Research Laboratory, Washington, D. C. Following his graduation from Cornell, he was employed by the National Electrical Supply Co. and was successively superintendent of construction, chief engineer, and vice-president. Since 1922, he had been with the Naval Research Lab; during 1944-46 he was consultant as special assistant to the superintendent of the radio division of the laboratory, becoming editorial adviser in 1946. Recently he received a Naval award and the Presidential award for his work with radar and remote control devices.

Carlos D. Hart, '06 M.E., retired in January, 1947, and formerly Visiting Professor of Industrial Engineering at the University of North Carolina, has been asked to rehabilitate a Japanese industrial plant which he installed in 1913 for the Int. Std. Electric Corp.

Robert H. Knowlton, C.E. '06, is now president of the Connecticut Light and Power Company in Hartford, Conn. He was formerly the executive vice-president of that utility.

Robert E. Friend, M.E. '09, president of the Nordberg Manufacturing Company received the award of Officer du Merite from the French Marine Mission in the United States at a ceremony in Milwaukee, Wisconsin, last spring. The award was presented by Commander L. Poirer in the name of Henri Bonnet, French Ambassador to the United States.

Marshall M. Koch, M.E. '14, has been elected vice-president and general superintendent of electrical operations of the Public Service Company of Denver, Colorado. He has been with the company since 1914.

Robert C. Edmunds, C.E. '18, who was formerly with the Central New York Power Corporation, is now with the Empire State Association of Commerce, Inc., New York's chamber of commerce at a State level, acting as a regional vice-president.

Francis W. Crandall, EE '25, has been appointed manager of the Washington, D. C., office of Ebasco Services, Inc. In 1939, Mr. Crandall was made executive secretary of the National Defense Power Committee; in 1942, he was commissioned a major in the AUS and appointed the Army's representative on power matters on the Army and Navy Munitions Board. Later, he was promoted to lieutenant colonel and was attached to the U. S. Military Mission to Moscow in 1944. Before joining Ebasco Services in 1947, he remained in the Office of the Chief of Staff as a civilian, initiating plans and procedures for peacetime power activities.

Ludolph F. Welanetz, M.E. '28, M.M.E. '36, Ph.D. '38, has resigned his post as associate professor in the U.S.N. Postgraduate School, Anapolis, Md., and has joined the Thiokol Corporation as General Manager of the Elkton Divisoin.

Thomas J. Higgins, E.E. '32, professor of electrical engineering at the Illinois Institute of Technology, Chicago, has been appointed to a full professorship in the college of engineering at the University of Wisconsin, Madison, Wis. He earned his Ph.D. in electrical engineering at Purdue University in 1941. While at Purdue, Dr. Higgins was an instructor in electrical engineering. During 1941-42, he was an assistant professor at Tulane University. The following year, he accepted an associate professorship at I.I.T.

Oliver N. Salmon, B.S. '40, Ph.D. '46, is one of five chemists who worked on the atomic bomb project, who have joined the staff of the Knolls Atomic Power Laboratory in Schenectady, N. Y., for chemical studies connected with materials used in an atomic "pile". Doctor Salmon did research on the production of high-quality glass for the Corning Glass Works during 1941-43. In 1943-45, he did research work at Cornell on propellants for projectiles.

Deceased

Henry Baum Brewster, M.E. '98, former chairman of the Onondaga County Democratic committee and manager of the industrial and art exhibit authority of the New York State Fair from 1936-44. From 1920-36 he was president of Brewster and Williams, Inc., Syracuse, consulting engineers.

Louis Swerdlove, C.E. '17, on May 21 last. He was employed as a civil engineer with the Board of Water Supply of New York City. In June of 1947, Mr. Swerdlove served as president of the 30th reunion of the class of '17.

Harry L. Brittain, M.E. '23, of Frederick, Maryland. He had been with the Consolidated Gas, Electric Light and Power Company of Baltimore.

Engineering Book Reviews

PRINCIPLES OF INDUSTRIAL ORGANIZATION, 6th Edition, by Dexter S. Kimball and Dexter S. Kimball, Jr. Published by McGraw-Hill Book Co., New York, 1947, 531 *pages,* $4.50

The sixth edition of Dean Kimball's text brings up to date one of the most influential, if not the most influential, text in industrial organization. A pioneer in its field 35 years ago, it still stands up as one of the most useable texts available to the teacher of elementary management courses.

This book varies from many of the other texts in industrial organization in that it is in no sense a handbook. It is designed as an elementary classroom text and serves that purpose admirably. All the material included is designed to strengthen the student's knowledge and comprehension of the basic principles of industrial organization without attempting to give him a catalog of all the different methods used to carry out these principles.

Principles of Industrial Organization appears to be particularly strong in the field of production control. The sections on scheduling and routing, including progress schedules, Gantt charts, and control boards are very clear and concise and should be completely adequate for the elementary student without adding the confusion of too many different methods or minor variations of standard methods. The sections on planning, dispatching, and inspection are equally clear and concise.

The material on motion and time study includes a broad description of current methods of making time studies with a stop watch including a series of data taken on actual jobs. Leveling, analyzing, and interpreting the data obtained is explained and discussed in detail such that the student is left with a comprehensive picture of methods used to set standards. A discussion of organized labor's principal objections to motion and time study and management's answer to these objections would have made the material of more value to the average engineer who will not take additional courses in motion and time study. This section would also have been improved by additional material on synthetic times, particularly methods of setting standards using times taken in laboratory such as A.B. Segur's motion-time analysis, since these methods are being used more and more by industrial concerns.

This edition has been greatly improved over the fifth edition by the insertion of a chapter on job evaluation and merit rating. Both of these subjects are of utmost importance for a clear understanding of the problems of setting and adjusting wage rates. More material on job analysis and a brief explanation of the now-quite-widely-used factor comparison system of job rating would have made this chapter even more valuable.

Though this book is certainly not intended to be used as a text in personnel management, it appears to be a little weak in that field. More inclusive material in connection with employee selection and placement, particularly interviewing and testing, and the handling of employee grievances would have given the student a better understanding of the vast problems to be solved in dealing with the human element.

In spite of the minor criticisms mentioned in the last two paragraphs, the sixth edition of *Principles of Industrial Organization* maintains the exteremly high level set by the preceding editions as one of the most practical and teachable texts in its field.

Martin Sampson
Asst. Prof. Administrative Eng'g.

PRINCIPLES OF JET PROPULSION AND GAS TURBINES *by M. J. Zucrow, Professor of Gas Turbines and Jet Propulsion, Purdue University. First Edition. John Wiley and Sons, Inc.* 1948. *563 pages.*

Dr. Zucrow's volume is among the first of expected textbook writings in a field so much developed by research and design during the years of the recent world conflict. Although a number of books have heretofore appeared on the subject of reaction type engines, they have been largely qualitative and semi-technical. Dr. Zucrow, however, has limited the popular descriptive material to a minimum and has directed his writing to the exposition of fundamental theories of propulsive gas flows. Important quanitative relationships appear throughout the book.

The author reflects his experience as a designer, an investigator, and a teacher. The book should appeal to the designer because of its broad treatment of quantitative relationships as they may be applied to such components of the turbojet engine as entrance and exit nozzles, compressor, turbine, and combustion chamber. In an effort to be complete in the application of turbojet engines to modern aircraft, the author has included a chapter on airplane performance and a chapter on the airplane propellor even though most of the material in these chapters are well treated by other authors.

It is evident that Dr. Zucrow has participated in research contributing to the understanding of the mechanics of the turbojet. He presents much of his own work on the performance of turbojet engines which has appeared in other sources. Because of his familiarity with research in this field he has been able to prepare the useful reference lists which appear at the end of each chapter; almost every phase concerning the turbojet is included, even that of high temperature metallurgy.

The main function of the book is that of serving as a textbook for students. With this end in view the material has been arranged to first review the principles of mechanics,

(*Concluded on page* 30)

TAU BETA PI ESSAY

WHY NOT CHEAT?

By WILLIAM WADE, CE '49

Today we see around us a school system where cheating is becoming more the rule than the exception. The basic reasons for this are of vital interest to all of us, not only as students and faculty but as citizens as well, for the causes and effects of cheating reach beyond the school walls into our daily lives.

Courses in Cheating

Several months ago, LIFE magazine featured a pictorial series based on the replies to the question, "Do you cheat?". The question was put to college students in many representative schools and the answers were all of the same tone. Photographs showed smiling students stating that they cheated consistently and demonstrating the various "cribbing" devices and techniques. These techniques and gadgets were ingenious and received the interest and applaud of students everywhere. Perhaps the most notable part of the article was the manner in which the students admitted their cheating. They did not have the tone of confessions but, on the contrary, were proud declarations of their skills. Previous to this article, an open letter published in the school paper of a West Coast university received nationwide interest. The student who wrote this letter was frankly and bravely demanding that the universities teach the sharp and underhanded business practices which he had found prevalent in the outside world. He argued that the school's duty is to prepare one to compete and win in outside competition and that in order to fulfill this duty, the student should be taught all the "shady" practices he will be required to compete against. He said, in other words, that cheating should not only be recognized, but should be taught.

Getting Away With It

Here we have the modern trend of thought in regard to cheating. It has changed from something disgraceful to something which is engaged in with free conscience. The question now offered is not "Is it wrong?" but "Can't get away with it?" The student of today, seeing his fellow student cheat, does not ostracize him, but, instead, accepts it as part of the mechanical, mathematical process of getting grades.

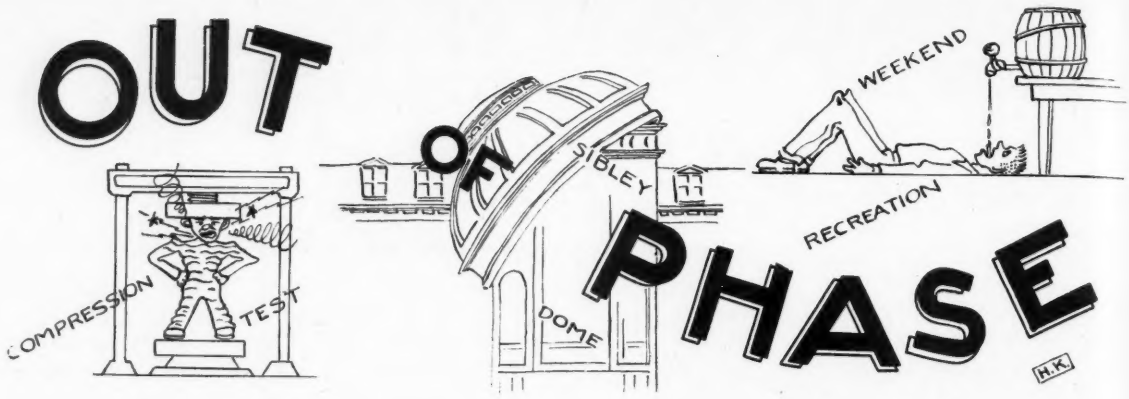
To men with these viewpoints, such platitudes as "Honesty is the best policy," and "You're only cheating yourself," are ineffective and meaningless. If there is a reason for not cheating, it lies deeper. What is cheating? Is it the taking of something which is not rightfully ours, as is stealing? It is said that we gain nothing by cheating, therefore, how can it be stealing? It is the copying of another's work or ideas? No, this is often done honestly under the name of research. The underlying evil of cheating is that it makes one unnecessarily dependent upon another person or thing. When we glance at a "crib" sheet during an exam, we are unnecessarily dependent upon a piece of paper for the solution to a problem we should have learned to do independently. When we copy another person's work we are dependent upon that person for the answer to our own problem. Cheating is a crutch upon which we become more and more dependent, and if the crutch is gone, we are cripples, unable to move independently. Cheating, then, is not so much a question of honor as it is a distorted perspective in which we cannot see the true value of independence.

This devaluation of independence is not confined solely to the classroom. In this highly specialized society of ours we are more and more dependent upon our neighbor for our food, clothing, and the other material things of life. This loss of independence shows itself clearly in newly made laws. The trend is toward government regulations producing security but taking away our freedom. The rapid growth of labor unions is another example of man trading his freedom for security. It is this same low regard for independence which reflects itself in the form of cheating.

Our country, however, was not always with this sense of values. The nation itself was founded by men who valued independence above all else. We were changed from a group of seaboard colonies to a great nation by the frontiersmen who regarded freedom of thought and action above the comfort and security of the crowded city. Wars were fought by Americans who loved independence more than life itself. It is this ideal which we are losing and which we must regain if we are to succeed as a student or as a citizen.

Gain a Confidence

The student with a desire to stand on his own two feet is a student who will equip himself to meet his problems alone. If he faces and masters each problem as it comes to him, he gains a confidence and knowledge which enables him to take the next problem in his stride. With independence of thought, there can be no cheating, and from independent thinking there results a better student, a better citizen and a better nation.



By HERBERT F. SPIRER, EP '51

We are turning this issue's column over to the problems of the incoming students of engineering, in the belief that they need every helping hand they can get.

By way of explanation, it might be said that this column is normally, if it may ever be called normal, devoted to local events of an humorous nature and satirical comments on the Cornell engineer's way of life. But we have been sickened by the treatment the new freshmen have received at the hands of most of our contemporary organizations.

We peer outside and see the hired ruffians of the *Daily Sun* holding a poor bespectacled frosh down and pushing lighted sticks under his fingernails in order to induce him to subscribe to their daily slopsheet.

And from near Barton Hall we can detect the horrible screams of some newcomer being convinced of the great efficiency of the Student Agencies Laundry Service system, y'know—leave a five dollar deposit and watch your shirts fall apart at the seams . . .

We will not be a party to this ruthless, heartless, and unwarranted exploitation of students before they know what is going on. Therefore, we have opened this column, and given up the usual bunk, to make way for letters from frosh who have turned to the ENGINEER for help and information.

The advice which follows is not the official opinion of the College of Engineering, nor does it represent the policy of the CORNELL ENGINEER, or its staff, or any members of their immediate families.

Dear ENGINEER:

I have been informed by my father who was a member of the class of 1922 *that examination papers are graded by marking* 60, 70, 80, 90, *on successive steps in a flight of stairs, throwing the papers upstairs onto the marked steps, and taking for the mark of any paper, the number on the step on which it falls. Is he pulling my leg or is this true?*

Anxious-to-Please.

Dear Anxious-to-Please:

Whoever told you this story is making a big joke and should be ignored. We have made careful observations of the technique used in marking examination papers. You should get used to calling them 'prelims'. This is an abbreviation of a sentence uttered before every test by the notorious Prof. Hogwash Sitzfleisch . . . "P'rhaps we c'n elim'nate some students t'day!". You will find that many Cornell traditions and customs have similarly obscure origins. You should not let this bother you, however, since it has never bothered the faculty.

Concerning marking systems, however, we have ascertained that they do *not* throw the papers upstairs—they throw them *down* the stairs. This is done because several years of experience showed that it was easier to throw the papers down, than up. And when it comes to the end of the term, they're pretty tired from this physical exertion so they use the setup shown below.

Dear ENGINEER:

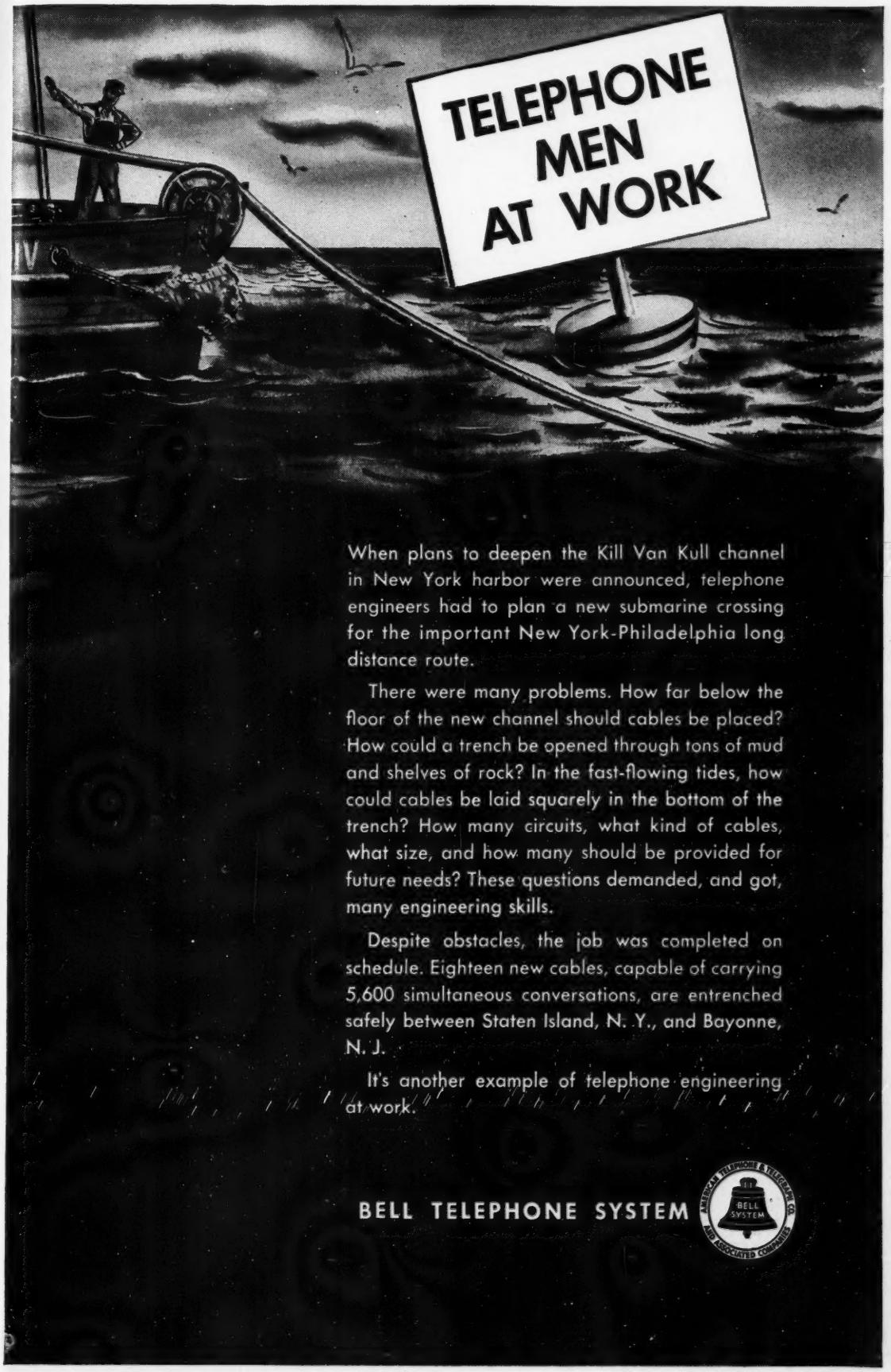
I come from poor but honest parents. My two brothers and my mother and father are working two shifts on an assembly line to help pay my way through Cornell. I have just received notice of another rise in tuition. Now the notice says that the University will take care of people like me. Should I go back to the smoked salmon factory or will the University take care of me?

Penniless.

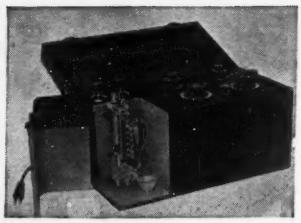
Dear Penniless:

Of course, the University will take care of you. You will be given some of the world's finest employment at a salary only ten cents an hour less than the national minimum hourly wage. You won't have to worry about making too much or where to spend your surplus sav-

(*Continued on page* 46)


TELEPHONE MEN AT WORK
When plans to deepen the Kill Van Kull channel in New York harbor were announced, telephone engineers had to plan a new submarine crossing for the important New York-Philadelphia long distance route.
There were many problems. How far below the floor of the new channel should cables be placed? How could a trench be opened through tons of mud and shelves of rock? In the fast-flowing tides, how could cables be laid squarely in the bottom of the trench? How many circuits, what kind of cables, what size, and how many should be provided for future needs? These questions demanded, and got, many engineering skills.
Despite obstacles, the job was completed on schedule. Eighteen new cables, capable of carrying 5,600 simultaneous conversations, are entrenched safely between Staten Island, N. Y., and Bayonne, N. J.
It's another example of telephone engineering at work.
BELL TELEPHONE SYSTEM
BELL SYSTEM

CAMBRIDGE electron-ray RESEARCH pH METER



RANGE AND ACCURACY: Sensitivity .005 pH; readings reproducible to .01 pH; accuracy .02 pH. Range 0 to 14 pH; 0 to 1200 M. V. *ELECTRON-RAY NULL INDICATOR:* Replacing the usual galvanometer, the electric eye provides quick and accurate null-point indication without possible damage to a delicate galvanometer. *NO BATTERY NUISANCE:* All-electric: plugs into any 110-volt AC Outlet. *ELECTRODE SYSTEM:* Sturdy glass electrode of condenser type is supplied. Micro or other glass electrode can also be furnished. *COMPACT AND PORTABLE.* Laboratory and Industrial Models also available. *Send for Bulletin 910 MA.*

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LINDEMANN ELECTROMETER

This instrument is extensively used for the determination of radio active emission. Has high sensitivity, good stability and does not require levelling.

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Here We Go Again !

As Cornell prepares to celebrate an 80th Anniversary, the Cornell Co-op begins its 54th year of service to Cornellians — 54 years on the Cornell campus.

The Co-op is so well-known to Cornellians past and present, that it should hardly be necessary to tell you these things, but as a reminder—

The Co-op has all the books and materials for your college courses. All equipment and clothing for college sports. Most of those things that you require for every day college living.

Convenient Location

On The Campus — Barnes Hall

Opposite Willard Straight

THE CORNELL CO-OP

College News

Dr. E. W. Hamlin

(*Continued from page* 19)

faculty September 1, 1947. At Cornell as director of the microwave astronomy project. Dr. Hamlin directed studies being made of extra-terrestrial electro-magnetic radiations in the frequency range normally used for radio communications, and was in charge of construction of the first radio astronomical observatory at any university.

Faculty Promotions

Dr. Edmund E. Day announced the promotion of faculty members to the rank of professor following action by the Board of Trustees.

They are: Donald J. Belcher, civil engineering; Howard M. Gifft, sanitary engineering; Wilbur E. Meserve, Malcolm S. McIlroy, and William S. Zimmerman, electrical engineering; and George Winter, structural engineering.

Promoted to associate professor are: Norman R. Gay, heat-power engineering; and Robert M. Mains, structural engineering.

Promoted to assistant professor: Alfred E. Davis, Merle J. Kelly, and William H. Wilder, electrical engineering.

Diesel Symposium

During the week of August 30-September 4, a program was held which was intended to improve instruction in diesel engineering and establish closer contact between industrial personnel involved in the manufacture of diesel engines, and the engineering faculty, according to Professor W. Julian King, director of the Sibley School of Mechanical Engineering.

Panel discussions, covering a multitude of diesel engineering topics, were supplemented by a series of demonstrations of the facilities of Cornell's Diesel Engine Laboratory. The laboratory, which was used to train more than 2,000 Naval officers during the war, houses more than 10,000 installed horsepower, representing all commercially important types of diesel engines.

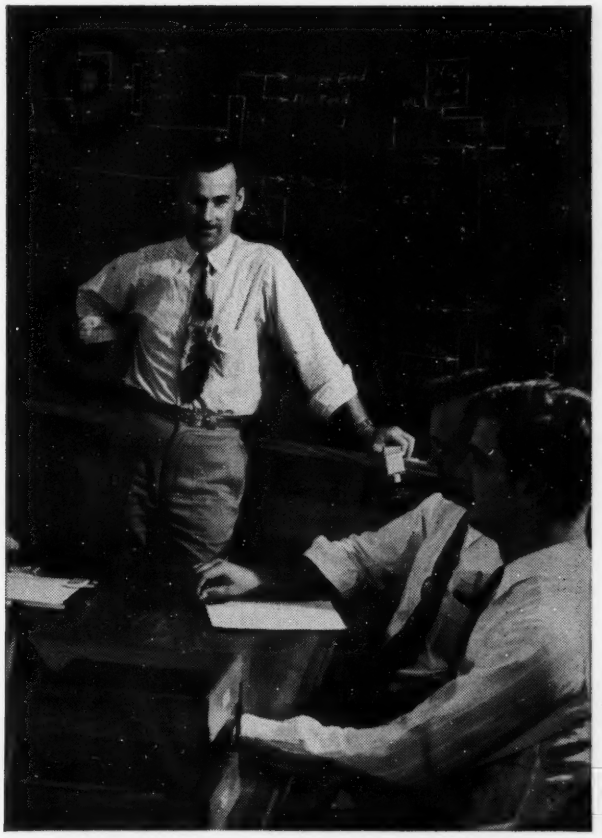
The symposium was arranged, Dr. King said, for college and university personnel experienced in heat-power and diesel engineering and actively engaged in teaching and research in the field, and for qualified engineers from the diesel engine manufacturing and allied industries.

Capital Equipment Course

A course in the sale of capital equipment, the first of its kind to be offered, was conducted this past summer by the Sibley School of Mechanical Engineering, in cooperation with the National Machine Tool Builders Association, and the American Machine Tool Distributors Association. The faculty consisted of forty-three leaders of the machine tool and related industries. Professor Harry J. Loberg of the Department of Industrial Engineering headed the staff.

SALLY CHERRY, one of the laboratory experts who keep Esso Products high in quality.

JOHN BRITTON, Esso Heating Oil Clerk makes up delivery schedules from card index of customer needs.



W. D. BEISNER, University of Minnesota '46, **C. T. STEELE,** University of Missouri '38, **R. S. PENDEXTER,** V. P. I. '41, confer on trouble phases of refinery operation.

Good PEOPLE are Good BUSINESS!

WILBUR HUNT, Pittsburgh '42 and **D. F. EATON,** Iowa State '34 discuss Wax Plant operations.

Salesman...lab expert...office boy or president—every one of our workers knows he has a wide open chance to keep on getting ahead in the company!...

Because every president of our company has worked his way up!

Over 30 years ago, our company set out to develop, with its employees, the best possible program of benefits for its workers.

Today our workers get exceptionally good wages and exceptionally steady work. Retirement on pension at 65. Vacations with pay. Special benefits in case of accidents, sickness or death. Company training for advancement to better jobs.

Some results?...Well, no important strike or labor disturbance in over 30 years, for instance. A staff of some 28,000 workers who bring to their jobs each day an average of over 14 years' service with the company —2,000 of them over 30 years!

This means a lot in a technical, competitive business. That's why we say—good *people* are good *business!*

Copies of our booklet, "Your Technical Career," are available at College of Engineering, Director of University Placement Service, and School of Chemical Engineering.

ESSO STANDARD OIL COMPANY

Prominent Engineers

Silvio C. Volpe

(*Continued from page* 21)

test to Cy's fine scholastic record. Cy is also one of the ME's interested in establishing a Cornell chapter of Pi Tau Sigma, national honorary society for administrative engineers.

Although born and raised in New York City, Cy expresses no love for that great metropolis; in fact he makes a point to spend as little time there as possible. Cy left the city to take his fourth year of high school at a private school on a Long Island estate. After his graduation from that luxurious establishment, Cy plunged into a back-breaking schedule; he held a full-time job, was studying accounting at night at Pace Institute, and was also taking a course in insurance salesmanship. On top of all this Cy was taking voice lessons and accordion lessons every week, and was devoting much time to practice besides. Even Cy, himself, marvels that he didn't crack under that grind.

"The war was the best thing that ever happened to me," he says.

It was in the Army that Cy first became exposed to mechanical engineering. Under the ASTP he attended the Newark College of Engineering for eight months. Although his work at Newark didn't give him any usable credits towards an engineering degree, it did influence Cy to choose engineering as his career. He spent the rest of his three Army years in ETO, serving in England, France, and Germany.

Cy entered Cornell after his discharge in the fall of 1945, and pledged Alpha Phi Delta shortly thereafter. He went to summer school in both '46 and '47, and will graduate this February, after which he intends to do engineering sales work. In whatever job he tackles, however, Cy's boundless energy and facility for getting along with people will form a hard-to-beat combination.

Book Reviews

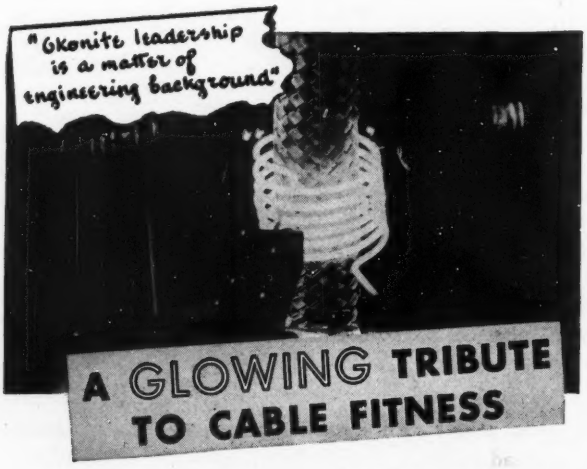
Jet Propulsion

(*Continued from page* 24)

thermodynamics, and aerodynamics before applying them to the compressor, turbine, and combustion chamber. The reading material is presented in the usual textbook manner supplemented by illustrative examples clarifying the application of basic principles. However, it is evident that because of the newness of the subject in the classroom no problems appear at the end of the chapters.

The most important chapter titles of the book are as follows: Momentum and Energy Relationships for Fluids, Thermodynamics of Gas Flow, Thermodynamic Properties of Air, Airplane Performance Calculations, The Gas-Turbine Power Plant, The Turbojet Engine, Air Compressors, Turbine Characteristics, The Combustion Chamber and The Rocket Motor.

F. W. Ocvirk, Assistant Professor, Graduate School of Aeronautical Engineering



Is a cable covering flameproof? Will it resist high temperatures when it comes to actual service?

Long before a cable is manufactured, questions like these are answered in the Okonite laboratories, proving ground and in various testing departments of the Okonite plants. The picture above shows a flame test. The measured current that makes the coils glow makes it possible to reproduce test after test without variation. The Okonite Company, Passaic, New Jersey.

OKONITE OKONITE SINCE 1878 5238

insulated wires and cables

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A Regents School where aim is to prepare students for University work.

Special attention to students with unusual programs or to whom English is a foreign language.

University Tutoring

Tutoring in university courses that is effective because directed to individual needs.

Special attention given to the needs of veterans

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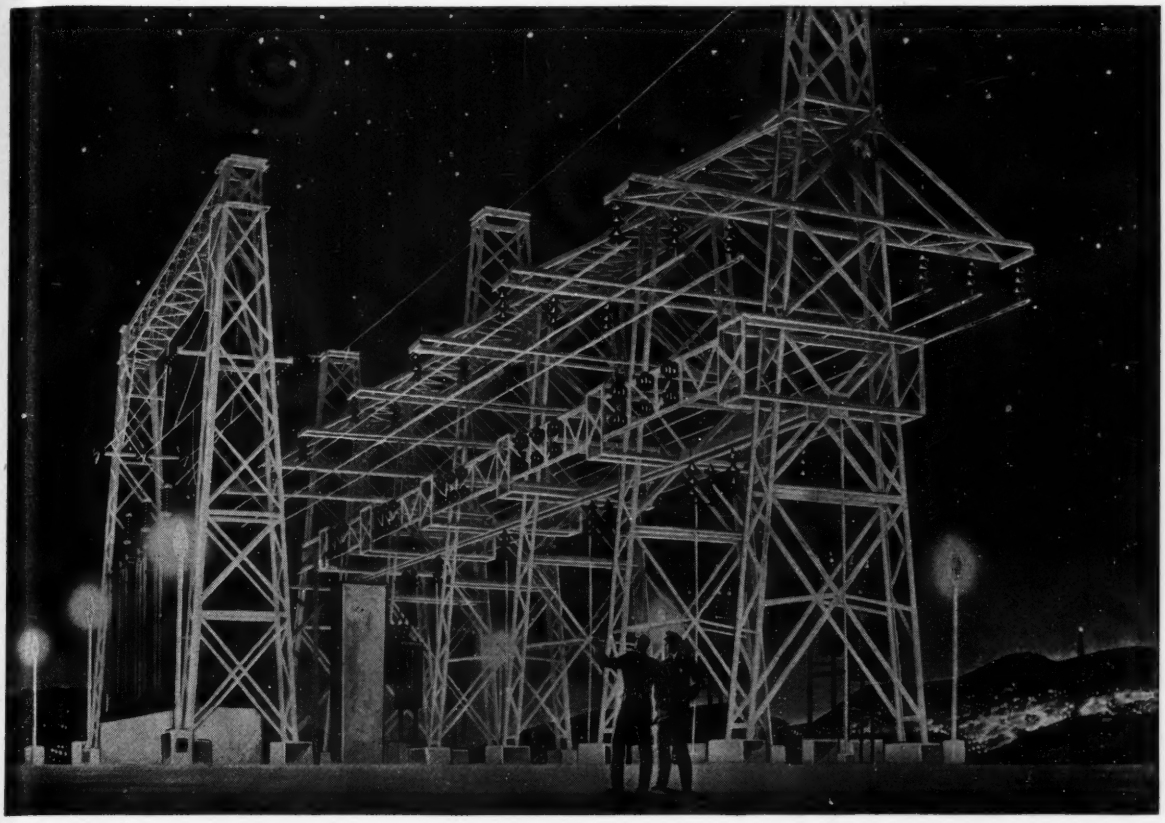
MAXWELL T. KENDALL '36, *Headmaster*



The skeleton where Volts are Housebroken

. . . with the help of
Alcoa Aluminum Structural Shapes

Electricity is transmitted in raging, sizzling, high-tension currents that couldn't be allowed to enter a home or factory. To "housebreak" this hot stuff—step it down toward a useful 110 or 220-volt distribution stature—is the job of substations.

The "skeleton" of each substation—the framework of beams and girders that support the transformers and equipment—is prey to weather, corrosive atmosphere, clinging dirt. Good maintenance has always called for frequent painting, and that called for shutdowns of electricity . . . until substation builders heard about Alcoa Aluminum Structural Shapes! Now the skeleton of a substation can be built, and routine maintenance painting forgotten. Among the standard shapes made by Alcoa, engineers find sections exactly suited to their needs.

It gives a whole new concept to structures—this building with Alcoa Aluminum Shapes. When they are used for bridges, railroad enginehouses, industrial equipment and similar structures, damaging red rust will never be a menace, painters will be freed from their frequent rounds! That's something to remember when you start putting your degree to work and are designing structures for industry instead of for grades. ALUMINUM COMPANY OF AMERICA, Gulf Building, Pittsburgh 19, Pennsylvania.

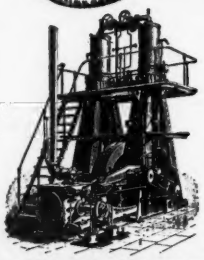
ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE

60 years ago aluminum was a novelty metal, used only for trinkets such as combs, watch fobs and napkin rings. Then along came a little company with two ideas firmly in mind—making aluminum *cheaper* and *better* so it could be more useful. That was the start of Alcoa, the start toward making aluminum so strong that it can often replace structural steel. Alcoa's 60 years of research and engineering development have swelled the uses of aluminum from a handful of trinkets to 4,000 different applications in industry, in homes, and on farms.

BROWN & SHARPE CUTTERS

Hudepohl BREWERIES USE FRICK Refrigeration 60 YEARS!

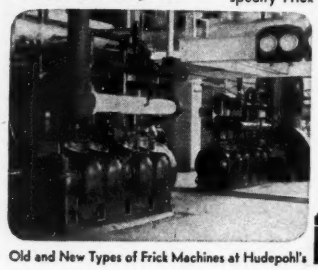


Frick ammonia compressors as built in the Eighties and Nineties were primitive machines by today's standards. But they were remarkably dependable: one of those installed in the Hudepohl Breweries at Cincinnati ran 57 years, another 52, and two others 45!

Naturally, Hudepohls believe in Frick Refrigeration. Their fine new engine room contains the two big Frick 4-cylinder machines illustrated.

You'll get the last word in reliability when you specify Frick Refrigeration. And you'll get equipment built to handle either ammonia, Freon, methyl chloride or carbon dioxide, to suit your special needs. All commercial and industrial sizes, 1/4 to 1000 horsepower. Let us quote on your requirements.

The Frick Graduate Training Course in Refrigeration and Air Conditioning, now in its 31st year, is approved under the G. I. Bill of Rights.



Old and New Types of Frick Machines at Hudepohl's

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

Use the CORNELL UNIVERSITY PLACEMENT SERVICE

Administration Building, Ithaca
John L. Munschauer '40, Director

New York Office, 107 E. 48th St.
Paul O. Reyneau '13, Manager

Maxwell M. Upson

(*Continued from page* 17)

rock, breakwater jetties 1½ miles into the Atlantic Ocean to enclose 750 acres of protected water and a 2000-foot marginal wharf and other port facilities; the building and modernization in South America of several ports; and the building of oil derrick bases, roads, railroads, waterworks and sewer systems, houses and industrial buildings in many countries.

Acquired Over 40 Patents

During his career as an engineer, Mr. Upson has received more than forty patents on work of his, on the whole concerning matters to do with concrete construction. His work as an executive also speaks well for him, as evidenced by the rapid growth and expansion of his concern. For the excellence of his work, he was awarded the Edward Longstreth Medal in 1940 by the Franklin Institute.

A trustee of Cornell University, Mr. Upson has been very active in alumni circles. In addition to this post of importance, he is a member of the Cornell Society of Engineers and the New York Cornell Club. Other organizations and committees to which he belongs are the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Concrete Institute, and the Committee for Economic Development, of which he is a trustee.

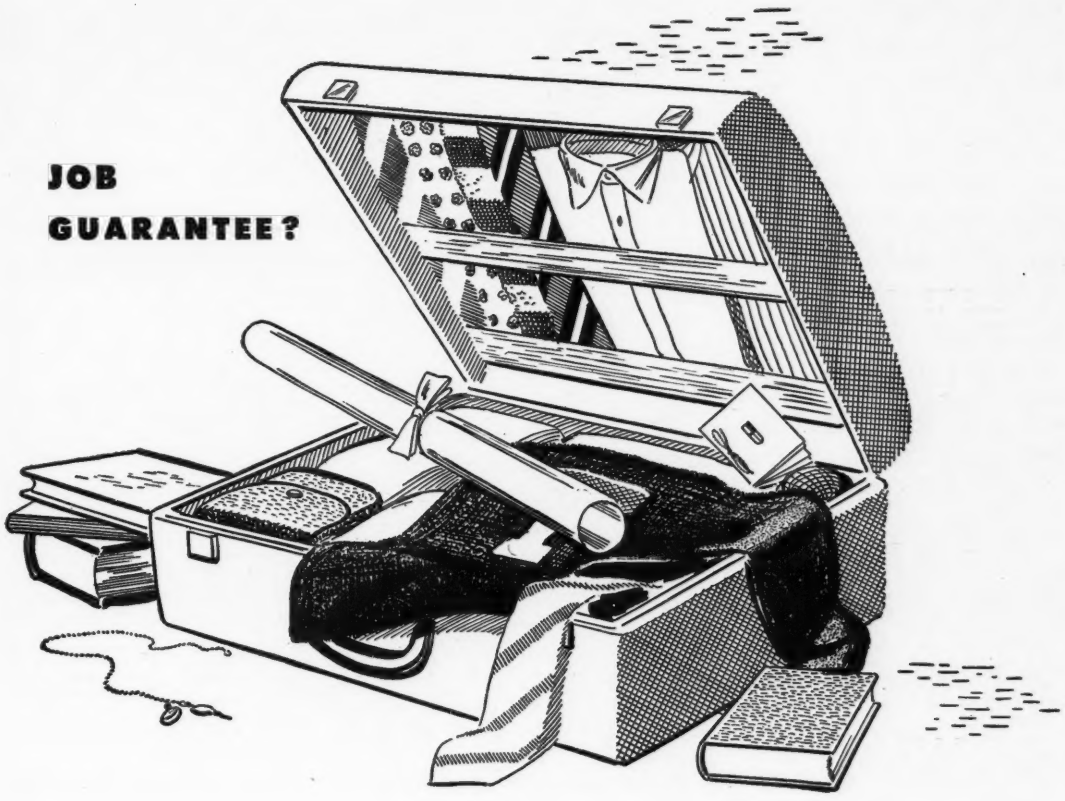
Freshmen Message

(*Continued from page* 20)

ricular activities, the wisest thing to do about them at first is nothing. That is to say, your time will be limited and it is important that you use it wisely. Look over the various activities and enter only those that you have time for. There are many that are worthwhile and some that are not. You will find that a competition, begun after careful consideration, will be much more valuable than one begun in the first month of school in an organization about which you know next to nothing.

Again, the CORNELL ENGINEER is happy to welcome you, and wishes the best of luck to the class of '53.

JOB GUARANTEE?



A college degree is the best job guarantee we know—and the best start toward a successful business career. You can be proud of your diploma, the education it stands for and what that education is going to mean to you.

Much of that education undoubtedly came from textbooks published by McGraw-Hill. They have helped you to understand the problems of the classroom. When you get into business, you should add the McGraw-Hill magazine devoted to your field to the McGraw-Hill books you will continue to use. It is the best way we know to help you keep abreast of the news and the new developments and methods you will need to know to get ahead.

In whatever branch of engineering you plan to enter—civil or chemical, mining or metallurgical—there are authoritative McGraw-Hill books. And when you're finally on that payroll, read the McGraw-Hill magazine devoted to your industry. Like your diploma, it can help you turn a job into a successful career.

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PUBLICATIONS

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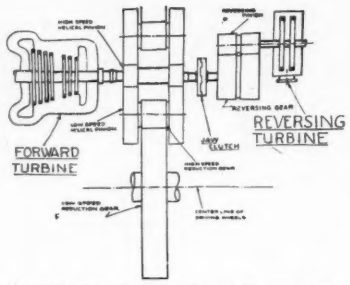
Turbine Locomotive

(*Continued from page* 13)

car load at the same speed. Such requirements can only be met if the boiler designer has greater freedom in the use of space. The compactness of the turbine drive gives the boiler designer greater opportunity to place larger sizes of boilers on any given locomotive frame. Larger and more efficient design made possible through the use of turbines which take maximum advantage of high pressure and high temperature steam conditions will materially aid in the eventual construction of turbine drive units as high as 10,000 horsepower.



SCHEMATIC DIAGRAM OF DRIVE UNIT

The inherent cyclic characteristic of reciprocating motion, due to unbalanced moving parts, causes a varying torque to be delivered at the rail in any given revolution of the drive wheel. This undesirable situation is overcome in both the turbine and Diesel-Electric drives. Power in the latter case is produced by smooth rotary motion which permits dynamic balancing of the rotating elements.

First American Built Unit

The turbine drive unit constructed by the engineers of the Baldwin Locomotive Works, Westinghouse Electric Co., and the Pennsylvania Railroad will be discussed since it is from this unit that performance data was compiled, and it is also the first American built geared turbine locomotive.

Steam is supplied by a fire tube boiler. This boiler can supply 95,000 lbs. of steam per hour at 310 lbs. per square inch gauge at 750 degrees Fahrenheit to the turbine. The drive unit proper is comprised of a forward turbine which rotates at a variable speed depending upon the quantity of steam supplied. It has a rating of 6900 horsepower. The forward turbine is connected to a high speed pinion which is never disconnected, even when the locomotive is moving in reverse, at which time it rotates backwards. When the locomotive is moving forward, this high speed helical pinion drives a helical gear which in turn drives a second spur gear reduction unit (the low speed gearing) resulting in a double reduction type of transmission. Such a scheme is necessary in order to maintain the speed of the turbine which operates most efficiently at a high R.P.M. The relatively low axle R.P.M. is thus maintained. A schematic plan view of the drive unit is shown in the figure at the left.

The final low speed spur gear transmits power to the axle and drive wheels through a flexible cup drive. Each cup drive contains two rows of cup assemblies with eight cups in each row. Within each cup there is a spring through which the torque applied to the spur gear is actually transmitted to the drive

(*Continued on page* 36)

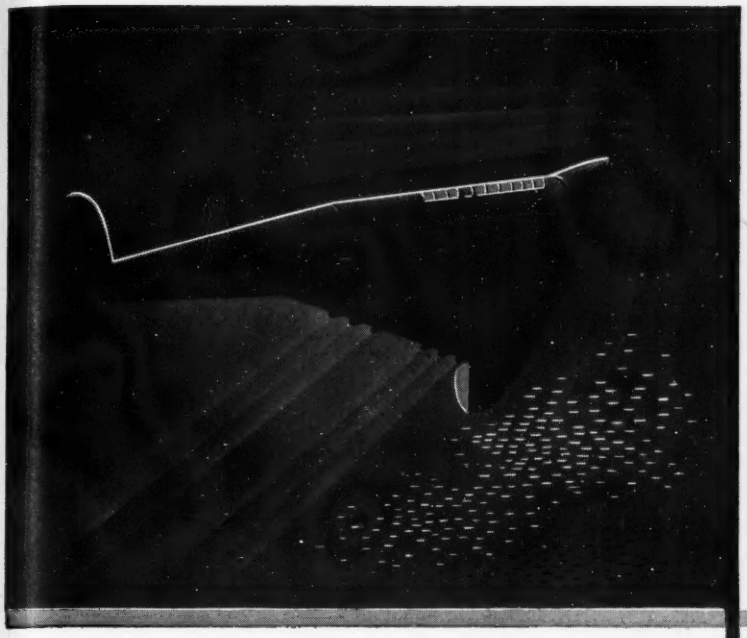
When FASTENING becomes your responsibility, remember this important fact — — —

It costs more to specify, purchase, stock, inspect, requisition and *use* fasteners than it does to buy them. *True Fastener Economy* means making sure that *every* function involved in the *use* of bolts, nuts, screws, rivets and other fasteners contributes to the desired fastening result — maximum holding power at the lowest possible *total* cost for fastening.

You Get True Fastener Economy When You Cut Costs These Ways

1. Reduce assembly time with accurate, uniform fasteners
2. Make satisfied workers by making assembly work easier
3. Save receiving inspection through supplier's quality control
4. Design assemblies for fewer, stronger fasteners
5. Purchase maximum holding power per dollar of initial cost
6. Lower inventory by standardizing types and sizes of fasteners
7. Simplify purchasing by using one supplier's complete line
8. Improve your product with a quality fastener.

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY
Plants at: Port Chester, N. Y., Coraopolis, Pa., Rock Falls, Ill., Los Angeles, Calif.



Moving faster!

Efficiency in many mechanical devices is often a matter of high speeds and low weight. The resultant stresses make heavy demands on parts, whether they be in aircraft or automotive engines, machine tools or locomotives.

Molybdenum is the only alloying element that gives steel the two vital necessities for meeting such requirements—good hardenability and freedom from temper brittleness. Molybdenum steels will also meet the requirements of production economy.

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CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS

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MOLY

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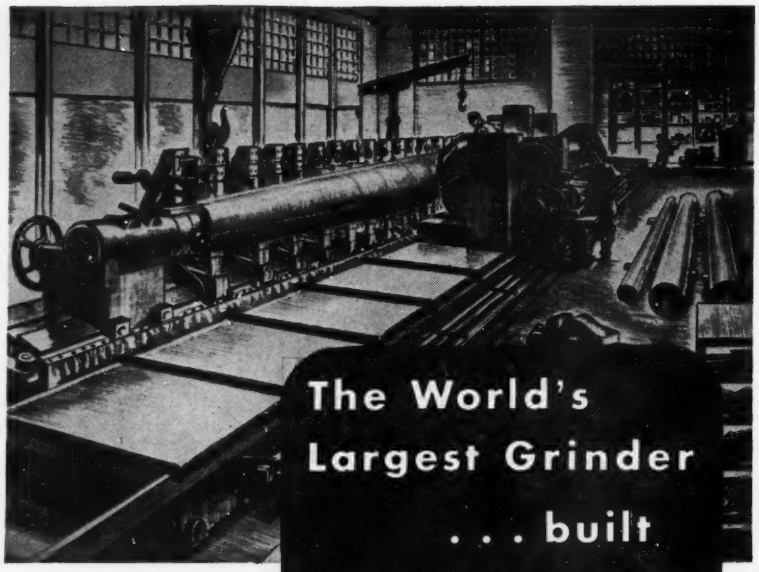

HERE YOU SEE the world's largest grinder receiving its final runoff test on one of the assembly floors of the Norton Machine Division. It handles huge cylindrical work as long as 68 feet and up to 36" diameter—and grinds such work to tolerances measured in fractions of a thousandth of an inch—approximately a tenth the thickness of this page.

The other extreme in the Norton line of cylindrical grinders is the tiny 4" Type C. There are also Norton machines for surface grinding, toolroom grinding, and such special work as automotive crankshafts and camshafts. And for producing still greater dimensional accuracy and higher surface finish, there's a line of Norton Lapping Machines—for both flat and cylindrical work.

Every Norton machine is expertly designed, expertly built and is expertly serviced by a highly trained field organization.

NORTON COMPANY, WORCESTER 6, MASS.

(Behr-Manning, Troy, N. Y. is a Norton Division)

NORTON

ABRASIVES — GRINDING WHEELS — GRINDING AND LAPPING MACHINES
REFRACTORIES — POROUS MEDIUMS — NON-SLIP FLOORS — NORBIDE PRODUCTS
LABELING MACHINES (BEHR-MANNING DIVISION) COATED ABRASIVES AND SHARPENING STONES

Turbine Locomotive

(Continued from page 34)

wheels. The cup type drive permits the transmission to be flexible under a sudden torsion load. This feature protects the gearing and turbine from shock.

A second auxiliary turbine known as a reversing turbine is provided for the purpose of running the locomotive in reverse. This unit permits a maximum reversing speed of twenty-two miles per hour at 1500 horsepower. The reversing turbine is not directly connected to the high speed helical pinion as is the forward turbine. Instead, a reversing gear is used in the reverse transmission system which "gears down" the reverse turbine shaft R.P.M. before it is connected to the high speed pinion. The gear ratio has the effect of multiplying the torque by four at the high speed pinion. The high starting torque which is required for reversing the locomotive is obtained in this way. The entire reversing unit is connected to the high speed pinion through a hydraulically operated jaw clutch.

The gear drive unit is situated between the second and third drive wheels of the locomotive. It is symmetrical with respect to the horizontal axis of the locomotive when observed from a plan view. The gear case supports both the forward and reversing turbine, and is itself supported by the locomotive frame at three points. The three point support is employed to prevent any distortion of the locomotive frame from being transmitted to the gear case and ultimately to the gears themselves.

Force Feed Lubrication

Lubrication is supplied by a force feed lubricating system. Two turbine driven centrifugal pumps supply the pressure head necessary to lubricate the bearings and gears. Only one of these pumps is actually in operation at all times. The second automatically cuts in upon failure of the first. A high viscosity turbine oil which is tested under extreme temperature conditions is used in this system.

The flow of steam in both the for-

(Concluded on page 38)

THE SALESMAN WHO CARRIED A GLASS PIPE!

"LOOK AT THIS, Mr. Irvin!" said Joe the salesman as he whisked a short length of glass pipe out of his briefcase.

"This is one reason why our food products are pure and clean. Right up to final inspection, they flow through Pyrex glass piping. We can see them all the time!

"We can keep the pipes clean easily without taking them down. And when they're clean, we can see they're clean. And what's more, food and fruit acids don't attack glass, so there's no danger of spoiling the taste!"

Glass pipe to guard the purity and quality of your product is only one of 37,000 things we make at Corning Glass Works.

We make the glass bowls for five best-selling coffee makers. We know the answers to a lot of questions about television because Corning has been making the glass parts for television from the start. And if you sold housewares, we could help you attract new customers with our Pyrex Flameware Double Boiler, made of the first glass ever specially developed to stand the extra shock of top-of-stove cooking.

In nearly a hundred years we've found ways to make 50,000 different kinds of glass. Some of them may someday help you improve production or cut costs. Others may suggest ways to make your product more desirable or useful to the people who buy it. Remember us when that day comes. Corning Glass Works, Corning, N. Y.

IN PYREX WARE AND OTHER CONSUMER, TECHNICAL AND ELECTRICAL PRODUCTS ▶

CORNING *means* Research in Glass

Turbine Locomotive

(*Continued from page* 36)

ward and reversing turbines is controlled from the steam chest which receives superheated steam from the boiler. This chest contains five valves, four of which are connected to the forward turbine and one to the reversing turbine. These valves are under the direct control of the engineer, and the developed turbine horsepower is a direct function of the number of valves which are opened. Each of the four valves supplies steam to approximately one-fourth of the periphery of the nozzle chamber which in turn supplies high velocity steam to the first stage of blades in the turbine. The blading used in the forward turbine is of the impulse type and is a multi-staged design. "Impluse in turbine design denotes a turbine in which the expansion of the steam that passes through it and makes it do work occurs almost entirely in its stationary nozzles or in its fixed blades; practically no expansion of the steam occurs in its moving blades."[1] The reversing turbine is a single stage design, and receives steam from the steam chest, from a single inlet pipe. Neither the forward nor reversing turbine units condense the exhaust steam and must therefore exhaust the steam above atmospheric pressure, at which time it still contains some potential energy. The use of a condenser in this unit was deemed unwise, however, from an economic point of view.

A number of novel construction problems were met and dealt with in the course of developing the turbine drive. In order to introduce an added safety factor, the contact hardness (450 Brinnell) of the high speed pinion and first reduction gear is nearly twice the hardness ordinarily employed. This is the first commercial use of hardened and ground double helical gearing. The method of grinding departs from the usual method in that it uses a flat grinding wheel and an unusual grinding set up. Some such innovation was made necessary due to the high accuracy requirements of the gearing. It is anticipated that further advances in this new grinding technique may make possible further economies in space and weight for future transmission units.

The latest development in the field of turbine locomotives is the construction of a turbine-electric drive for the Chesapeake and Ohio Railroad. This unit steps down the speed of the turbine by means of an electric generator. The electrical energy of the generator is then reconverted to mechanical energy, through the use of individual motors at each of the locomotive drive wheels.

The optimism displayed by turbine engineers concerning the future of turbine locomotives seems to be well founded. As more performance data continues to be compiled on other units of even larger power output, the case for this type of drive should be even more conclusive.

1. Croft, Terrell, *Steam Turbine Principles and Practice,* McGraw-Hill Book Co., Inc., N. Y. C., 1940.

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THE INTERNATIONAL STANDARD OF EXCELLENCE
SINCE 1880
HIGGINS
Higgins non-tip rubber base keeps your Higgins American Waterproof India Ink upright. . . . Ask your dealer for both.
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271 NINTH ST., BROOKLYN 15, N.Y., U.S.A.

President's Message:

The Cornell Tradition

(*Continued from page* 22)

only our plaudits, but our wholehearted and effective cooperation.

The present administration in the Engineering College, under the wise and able leadership of Dean Hollister, has done such a job these past ten years, despite terrific problems and handicaps.

If you have not read Dean Hollister's report on this period, published in President Ostergren's May letter, you should do so, for then I am confident you will be convinced that our present administration in engineering at Cornell fully meets the high standards necessary in this atomic age.

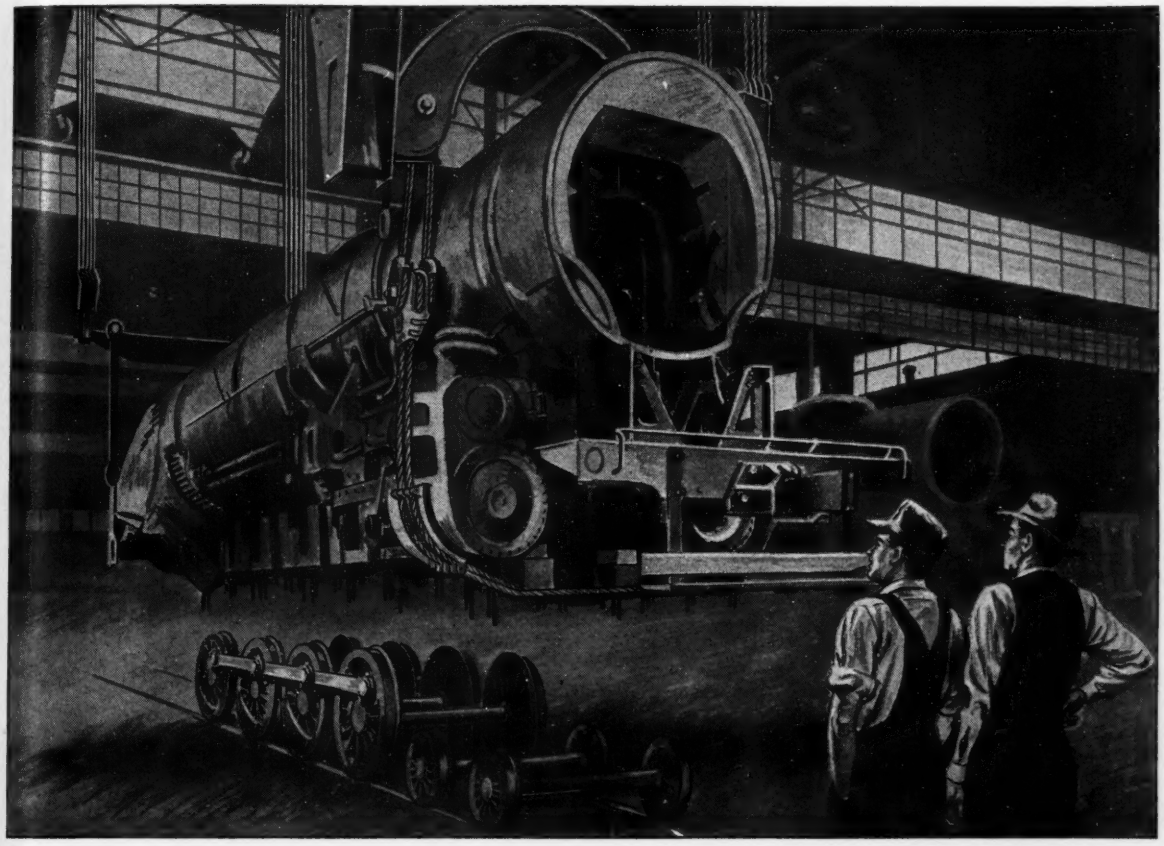
Pre-eminence in every phase of engineering education is a tough assignment, almost impossible you might say, for any university.

But we have the makings, the challenge is great, and Cornell has never refused such a challenge.

So, today, you and I have the opportunity to share in a great adventure: That of helping through our interest, cooperation, and support to preserve and enhance Cornell's great engineering reputation—to build into the lives of future Cornell Engineers, and through them into the lives of our countrymen, the Cornell tradition of "Freedom and Responsibility."

CREED W. FULTON

These live lines are cheaper than headlines



Guy de Maupassant's classic about the Frenchman whose mania for saving string brought ruin upon him, is an object lesson for wire rope users.

Courting trouble through a misguided sense of economy applies to wire rope, too.

The prevention of waste is a commendable effort but, it should be exercised before, not after the rope has outlived its usefulness. It should be exercised in the selection of the right rope for the job, its proper installation and care.

The man who roots through a scrap pile for a short length of rope that is "good enough" to serve as a sling, should remember that a wire rope, too, is only as strong as its weakest link.

Our free enterprise system has created markets that demand the output of millions of workers. Roebling slings were developed to increase the efficiency of these workers, and to insure their safety.

Scientifically designed for a widespread variety of requirements, Roebling slings have won the confidence of management and worker alike . . . throughout the world.

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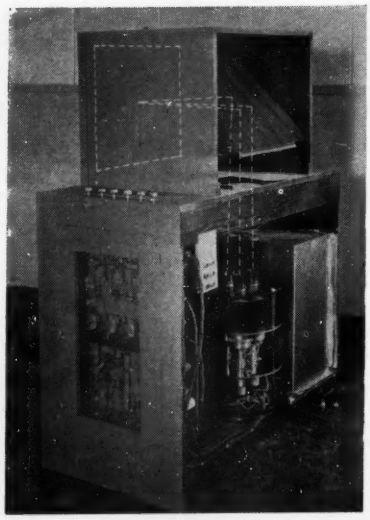
A CENTURY OF CONFIDENCE **ROEBLING**

Color Video

(*Continued from page* 15)

separate carrier or a sub-carrier). This is of utmost economic importance as it permits the use of a present day monochrome receiver with a simple radio frequency converter on the green channel, producing a good quality picture, as the color spectrum response of the green and monochrome channels are approximately the same. This will greatly ease the transition from black and white to color, and overcomes the abrupt change feared by manufacturer and customer alike.

With all these modifications, the RCA system assumes a very practical aspect. Commercial use must await the development of satisfactory wide band transmission circuits, studio equipment, and low-cost receivers, and the system must be thoroughly field tested. Little data is given on resolution values of the system but from "Kodachrome" slides better than 400 line actual resolution has been obtained, giving an apparent resolution on the order of 1000 lines.



Three 3-inch kinescopes project the 3 pictures simultaneously to the translucent viewing screen by way of a 45-degree mirror as shown by the dotted lines.

Equipment and Transmission

Studio equipment for the two systems is, of course, different, but contains few radical changes. Initial cost is higher than black and white, but relatively unimportant in the light of program production costs.

The sequential system uses, for studio and outdoor pickup, image orthicon picture tubes, and for films and slides, iconoscopes. Very high levels of illumination must be used in the studio, the heat making everyone uncomfortable—one reason studio iconoscopes for monochrome are going out of use. Another difficulty of the system is that some charge, stored in the image orthicon while one color filter is in place, is discharged during the next color period, with consequent color distortion. Auxiliary equipment is of the same style as black and white, although much more complicated, and of necessity includes color monitors.

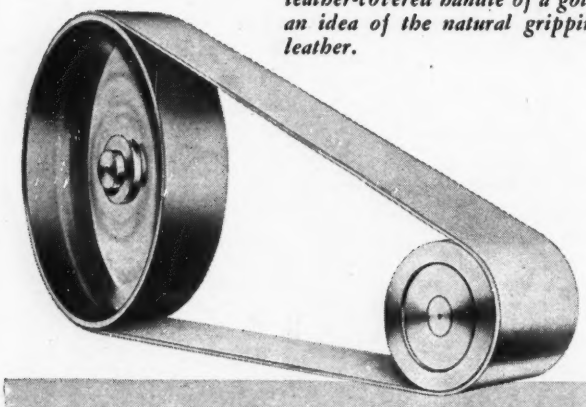
The three image orthicons used for studio and outdoor pickup in the simultaneous system give good results on illuminations similar to black and white setups which use image orthicons. For film and slide

(*Continued on page* 44)

LEATHER HAS THE GIFT OF "GRAB"

that puts power to work

When you wrap your hands around the leather-covered handle of a golf club, you get an idea of the natural gripping capacity of leather.



That same grip or high coefficient of friction makes leather an outstanding material for modern power transmission. The full-grain, pore-like surface of a leather belt provides a positive, non-slip pulley grip that assures continued maximum efficiency.

That's why leather belting is turning so many wheels in today's industry.

AL-17

American LEATHER BELTING *Association*

Headquarters for Authentic Power Transmission Data

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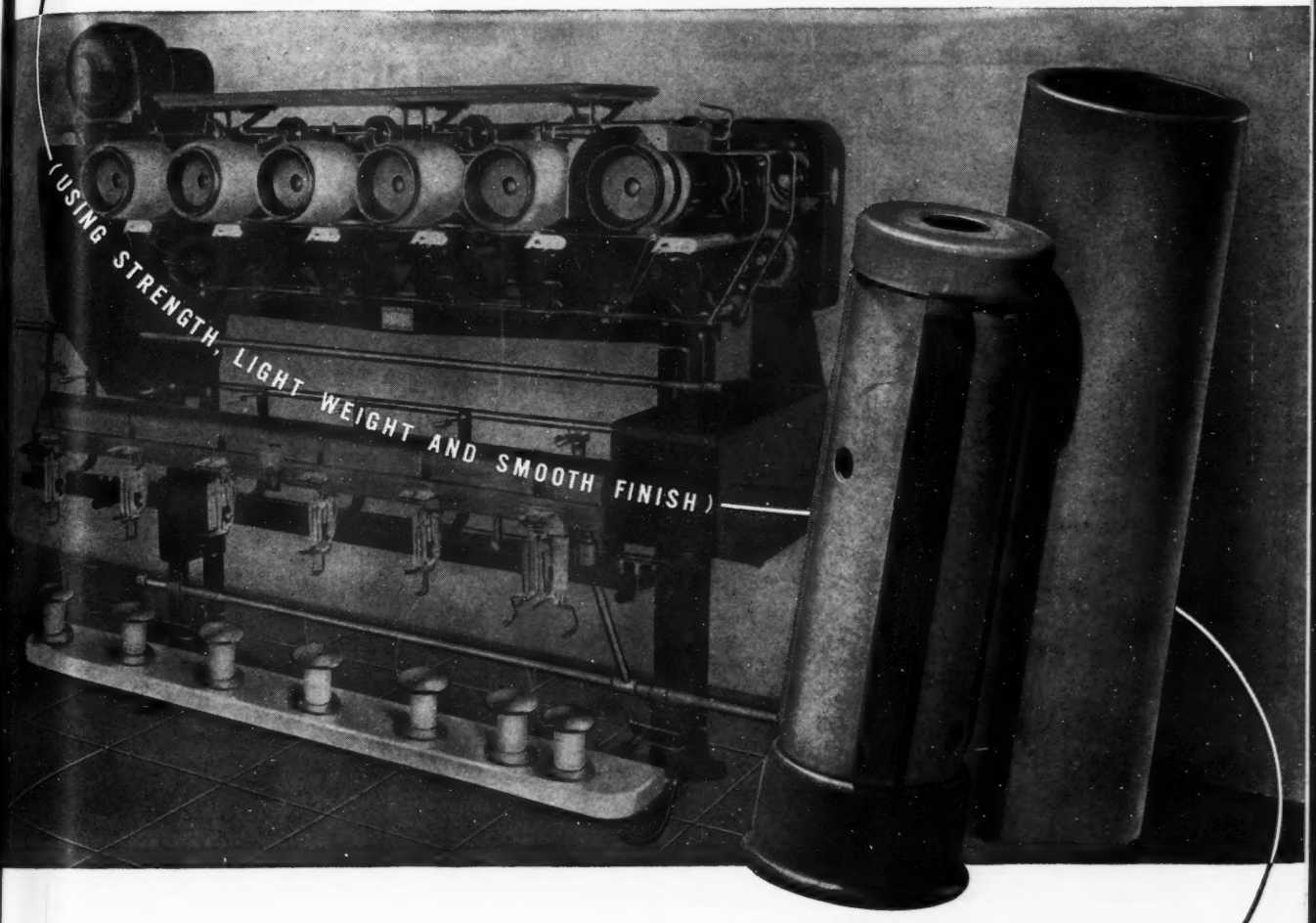
Plastics where plastics belong

Because of a unique combination of chemical, electrical, and mechanical qualities, Synthane laminated plastics can be applied to an endless number of practical purposes. Moisture and corrosion resistant, light-weight and structurally strong, Synthane has many collective advantages not readily found in any other material. One of the best electrical insulators known, Synthane is hard, dense, durable . . . quickly and easily machined.

Among the interesting occupations of our type of technical plastics are the redraw bobbin and chuck (below) used in winding fine denier nylon for women's hosiery.



Fine nylon filaments can be wound without pulling and sticking because of the smoothness of the bobbin. Light weight of bobbin and chuck allows the spindle to be started and stopped faster and with less effort. Greater crushing strength of tube permits larger amounts of nylon to be wound. This is an appropriate job for Synthane, an interesting example of using plastics where plastics belong.
Synthane Corporation, 1 River Road, Oaks, Pa.

SYNTHANE

where Synthane belongs

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FABRICATED PARTS • MOLDED-MACERATED • MOLDED-LAMINATED

Norton
Printing Co.

317 E. State St. Ithaca, N. Y.

Color Video

(*Continued from page* 42)

pickup a projection cathode ray tube is used to provide "flying spot" scanning, and color separation and pickup is accomplished by dichroic reflectors and a multiplier photo tube, respectively. These photo tubes have a high signal output, and their internal noise is proportional to light intensity, giving an approximately constant and very high signal to noise ratio. Auxiliary equipment is again similar in style to monochrome, and again much more complicated.

The radio frequency equipment in both systems is the same except for modulating equipment, but must be of much higher power than for monochrome, because of the wider bandwidth needed (15 mc vs. 6 mc) at a much higher carrier frequency (500-900 mc vs. 50-200 mc). Counter-balancing this is the fact that highly directive antennas can be made for the same size requirements, increasing gain over monochrome antennas by 14-20 decibels. Propagation effects at the higher frequencies have not been analyzed fully, but radio gain decreases with increased frequency, and diffraction effects around hills and buildings become sharper and more troublesome. No studies have as yet been made on the affect of "ghosts" on color, although, because of the higher frame repetition rate of the sequential system, they are expected to be more troublesome on that system than on the simultaneous. The distance of transmission will be even more limited to radio line of sight because of the higher frequencies involved, although occasional long distance transmissions may be obtained by tropospheric "trapping", which increases in probability with increase in frequency.

Receivers

The final element in equipment is the receiver, always important because of the large public investment. No estimates on cost have as yet been given for receivers for either system, but it is probable that receivers for either under mass production will cost about twice what present day monochrome receivers do.

Both types of receivers have a light loss in reproducing the image, 6 to 1 in the sequential and 1.5 to 1 in the simultaneous, caused by system and optical filter limitations. The color wheel in the sequential system and the lens system for recombining color components in the simultaneous system have no counterpart in monochrome, and special care must be taken in both systems in shielding and hum filtering, as these are made more critical by increased bandwidth and apparent resolution.

The only further specific circuit necessary in the sequential system is a pulse detection circuit and low-pass filter to recover the pulsed sound. The rest of the receiver circuits, except for the color synchronizing circuits, are the same as black and white.

The light loss in the simultaneous receiver is due to the fact that the best phosphors for projection work are not always exactly the right

(*Concluded on page* 46)

DU PONT Digest

For Students of Science and Engineering

From tire cords to football pants

Do you know about nylon's other lives?

Here's a surprise for those who think of nylon mainly in terms of stockings and lingerie.

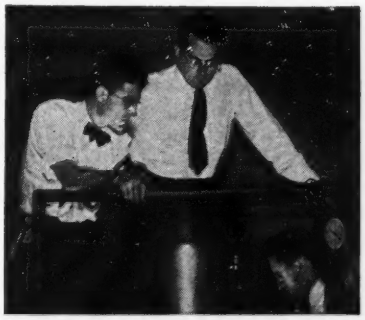
Nowadays, nylon fibers—twice as strong and half as heavy as the same size aluminum wire—are doing a variety of jobs, better than any previously known fiber. Off Labrador, men are harpooning whales with nylon lines. In a New England textile mill, abrasion-resistant nylon ropes now drive big "mule spinners" for periods ten times as long as other commercial materials, without a breakdown. Nylon fabrics are being used in everything from rugged automobile seat covers to delicately woven filter cloths.

In its plastic form, nylon is used to make everything from unbreakable dishes to hypodermic needles. As a monofilament, it goes into a variety of products from brush bristles to surgical sutures.

Nylon cords *give giant truck and airplane tires the strength and elasticity to absorb tremendous impact shock without bruising.*

Water won't hurt the nylon strings *of this racquet. They resist breakage over an extended period of time. No tiny strands to fray.*

Nylon football uniforms, *as worn by Bobby Jack Stuart, Army back, are not only tough wearing, but much lighter and quicker drying.*



Nylon research: *O. C. Wetmore, Ph. D. Phys: Ch., New York U. '44; D. A. Smith, B. S. Mech. Eng., Purdue '40; C. O. King, Sc. D.-Ch. E., Mich. '43, charging experimental condensation polymers to a spinning machine.*

Nylon owes its origin to a Du Pont fundamental research project begun in 1928. A group of scientists set out to find out how and why the molecules of certain substances polymerized to form giant chainlike molecules. Hope of obtaining a new commercial fiber was first aroused when, two years later, a polymer was developed which could be drawn out into a thin strand, like taffy candy. The complex problems which followed called for the services of over 200 Du Pont men and women, among whom were some of America's most competent scientists and engineers.

Research—a Major Du Pont Activity

Nylon is an excellent example of modern research at work at Du Pont. Young scientists joining the organization now may share in other discoveries of outstanding importance. They may find opportunities in such challenging fields as finishes, coated fabrics and various fibers; synthetic organic chemicals, including fine chemicals; synthetic rubber; electro and agricultural chemicals; plastics; pigments and photographic film; and high pressure synthesis.

Each of ten manufacturing departments of Du Pont has its own staff and is operated much like a separate company. Within each, research men work in groups small enough to bring quick recognition of individual talent and capabilities.

Year after year, young, inquiring minds come from leading U.S. schools of science and engineering to Du Pont—where individual ambition is matched with opportunity, cooperation and the type of friendly support that brings out the best in each person.

DU PONT
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More facts about Du Pont—Listen to "Cavalcade of America" Monday Nights, NBC Coast to Coast

You'll want to read this free booklet

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Color Video

(*Continued from page* 44)

color, and filters may have to be used. Also there is some absorption in the lens system. The experimental receiver proposed by RCA used three cathode ray tubes parallel to each other, with blue, green and orange (with red filter) phosphors. An earlier experimental tube with three electron guns in one tube (with a white phosphor and three color filters) was abandoned because of poor resolution and intensity, and a lack of fine adjustment of individual picture size and position which is very critical in this system. Recent proposals have been to use three tubes of a radial alignment and combine the images with dichroic reflectors which should almost eliminate light loss. However, data has not yet been published on the results of this method. The cathode ray tubes used must be of the aluminum backed kind to reduce spurious charges which would interfere with alignment, and the system of d.c. restoration must be good so black levels of all three colors, as well as contrast, are the same.

Summary

From the foregoing, it may be seen that a simultaneous color system offers many more advantages as a color system than does a sequential system. For a given bandwidth the resolution and signal to noise ratio are higher, sound is better, the disadvantage of moving parts is no longer present, studios will not need such hot, high intensity lighting, initial and operating costs are no greater, and the simultaneous system provides an economically satisfactory transition from monochrome to color. There only remains a matter of a few years of research, development, and testing before a simultaneous color system will show such economic and technical superiority over black and white that it must attain commercial status, and eventually, within our lifetime, it should replace monochrome television to the extent that sound has replaced the old silent motion pictures.

Out of Phase

(*Continued from page* 26)

ings, since there should be a rise in room rent any day.

Dear ENGINEER:

Is it true that Chemical Engineering is the hardest course in the school, like it says in LIFE?

Erlenmeyer Flask

Dear Earl:

There are only two easy courses in college, the one you wish you had taken, and the one you would transfer into if your marks were high enough.

Dear ENGINEER:

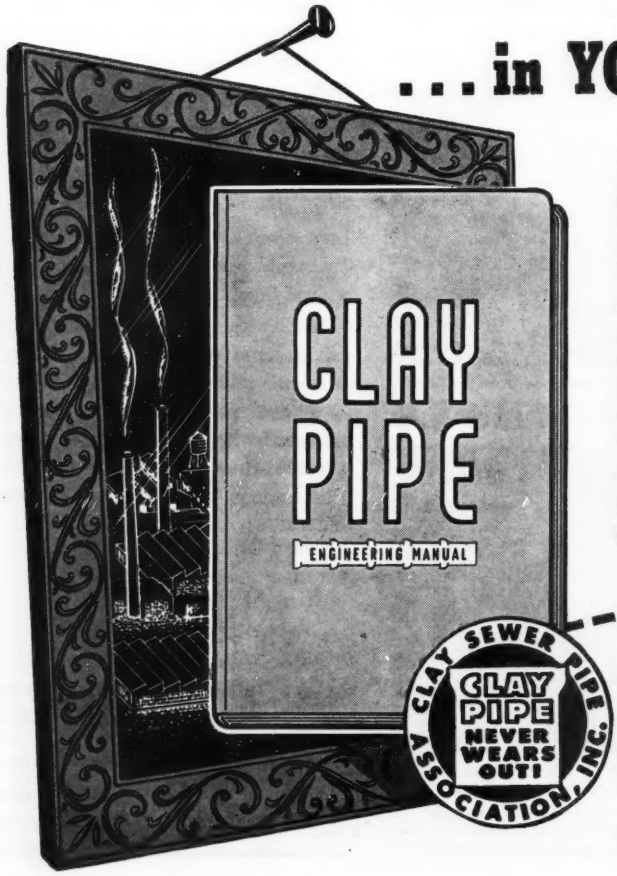
Will I be able to kiss any coed that I can get to walk across the suspension bridge with me?

Lover Boy

Dear Lover Boy:

There is an old Cornell tradition that if a coed goes across the Suspension Bridge with you, you have the right to kiss her. However, you have not yet been to Cornell, so whether or not you will want to exercise your rights will be up to you.

(*Concluded on page* 48)



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Underlying great construction projects, "out of sight and out of mind," lay the sanitary sewerage and drainage systems that are the foundations upon which the health and progress of modern civilization are built.

Engineers know they can depend upon modern Vitrified Clay Pipe to withstand trench loads unknown a few years back, to withstand abrasion, resist corrosion and NEVER WEAR OUT!

If sewerage and drainage planning is in *your* "future picture", fill in the coupon. Clay Sewer Pipe Association, Inc., will send you FREE the only official Clay Pipe Engineering Manual available. It contains Clay Pipe application data to help you get the right start with the *right materials* on your engineering career.

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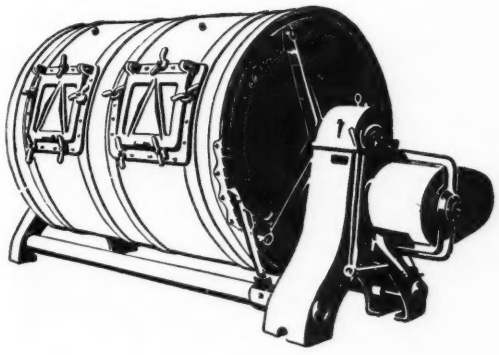
I certify that the above is a senior student in engineering studies leading to a career in engineering involving sewerage and drainage design.

Signature of Dean_____

CS-948-3

Another page for **YOUR BEARING NOTEBOOK**



How to turn a churn of butter better

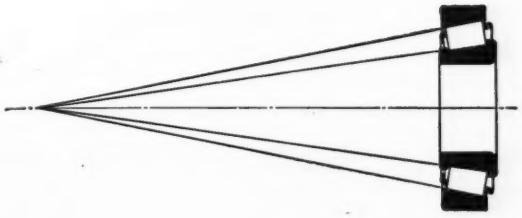
Engineers who design creamery equipment have found that a sure way to keep a churn turning smoothly, quietly and steadily is to equip all journals and countershafts with Timken tapered roller bearings.

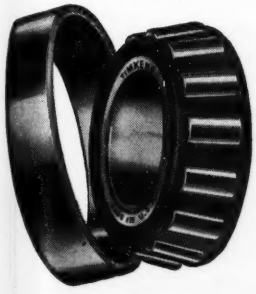
Because Timken bearings have true rolling motion and take both radial and thrust loads in any combination, the churn drive operates with less power, less wear, less maintenance. And with Timken bearings, more effective closures are possible, keeping lubricant *in* and dirt *out.*

Why Timken bearings have true rolling motion

The rollers in Timken bearings really *roll.* That's because rollers and races are precisely tapered so that all lines coincident with their tapered surfaces always meet at a common point on the axis of the bearing.

This means friction-free operation, minimum wear, greater precision. It's another reason why 9 out of 10 bearing applications can be handled more efficiently with Timken bearings.





TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Would you like to know more about bearings?

Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'd be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL ⬮ AND THRUST ⊣⬮⊢ LOADS OR ANY COMBINATION ✳

partners in creating

For 80 years, leaders of the engineering profession have made K & E products their partners in creating the technical achievements of our age. K & E instruments, drafting equipment and materials—such as the LEROY† Lettering equipment in the picture—have thus played a part in virtually every great engineering project in America.

†Reg. U.S. Pat. Off.

KEUFFEL & ESSER CO.

EST. 1867

NEW YORK • HOBOKEN, N. J.
Chicago • St. Louis • Detroit
San Francisco • Los Angeles • Montreal

Out of Phase

(*Continued from page* 46)

Dear ENGINEER:

Residential Halls has just informed me that I have been assigned to the temporary dormitories.

1. *What does this mean?*
2. *What should I do?*

Homeless

Dear Homeless:

We can only answer question number two. You should immediately apply for admission to another school.

Dear ENGINEER:

I am a girl freshman engineer. The girls tell me that there are seven men to every woman in Ithaca. I think I am very attractive but I don't want to bother with men when I should be studying. What should I do to avoid being trapped by Cornell men?

Nellie.

Dear Nellie:

Head for the roundhouse, they will never corner you there.

LAVA

Manufacturers of Super-Refractories Only

o

REFRACTORY CRUCIBLES
GRAPHITE CRUCIBLES
HIGH-TEMPERTURE CEMENTS
SPECIAL REFRACTORY BRICK, TILE, SHAPES

o

From the Following Materials:—

GRAPHITE **SILICON CARBIDE** **FUSED ALUMINA** **MULLITE**
MAGNESIA **ZIRCON**

o

LAVA CRUCIBLE COMPANY of PITTSBURGH

Pittsburgh, Pennsylvania

The Miracle

you put on your eggs...

Just plain Salt! But what wonders it performs in the hands of expert chemists and engineers. Its two components play a big part in the production of paper, soap, glue, metals, metal products, textiles, insecticides. They help to sanitize water, launder clothing, kill bacteria in dairies, restaurants, food plants.

"Miracle-working" with Salt—as well as other basic chemicals—has been Pennsalt's business for 98 years. Starting with a modest plant at Natrona, Pa., Pennsalt has steadily grown, until today it stands as one of America's important chemical companies.

Big? Yes . . . but not so big as to swallow up its promising young men. Old? Yes . . . but not too old to adopt young ideas that are sound. Pennsalt was founded by a young man; and grew large through the efforts of young men.

The future, too, looks bright for Pennsalt . . . and for the young men who are going to build it. Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

PENN SALT

CHEMICALS

Techni-Briefs

(*Continued from page* 18)

half times as large as its original size it is placed in position. As it dries it shrinks to a size smaller than it originally had been and forms a tight fit around the product. General Electric Company, producer of the sleeves, states that the sleeves are also being used as coverings for cable ends and for grips for pliers, wrenches, and wire cutters.

Snow Crystal Recorder

In order to further the research on weather now being conducted for the Army and the Navy an instrument has been developed which will measure the sizes, shapes, and numbers of snowflakes falling during a snowstorm. It is hoped that with this information further knowledge may be obtained of the number of tiny nuclei of dust or salt that is necessary to keep a snowstorm going.

Engineer examining an automatic snow crystal recorder.

The instrument, known as a snow crystal recorder, is set up in an exposed position. During the snowstorm the snowflakes fall on a special paper coated with a water-soluble dye. The engineer in the photograph is examining the small recorder. A small amount of heat is applied beneath the paper. The snowflakes melt as soon as they strike the paper and leave an impression, dark blue in color, indicating their shape and size. The instrument operates automatically and exposes a sheet of paper for one minute, every fifteen minutes during the storm. Later, analysis of the papers permits the determination of the number, size, and type of flakes falling during each fifteen minute interval while the storm persisted. If the location of the instrument is representative for the surrounding area, the analysis may be extended for the entire area covered by the storm.

Glass Glue

A new adhesive designed for bonding silicone rubber to itself and to glass, metals, and ceramics was recently produced by the General Electric Chemical Department. It is also useful in bonding glass to glass, glass to metals, and metals to metals, and remains flexible and resilient over temperatures ranging from —70°F. to 520°F.

ATTENTION – Frosh Engineers.

BOOKS and SUPPLIES for Your Courses.

DRAWING INSTRUMENTS

K. and E. Minusa at $37.00 & $39.00
K. and E. Mercury at $23.00
K. and E. Neptune at $21.00
Dietzgen National Commander $31.75

SLIDE RULES

Log log K. and E. $18.00
Polyphase $11.00
Beginners .....$ 2.25
6" $5.75 and .....$ 6.50

All kinds of engineering supplies at the

TRIANGLE BOOK CO-OP

OPEN EVENINGS

Discharge end of continuous tin plating unit showing bright polish of strip after electrolytic plating and high-temperature fusing by Gas-fired radiant burners

Tin coating is fused to steel as the strip passes between SELAS Gas-fired radiant burners. Close-up of the high-temperature section of the continuous line shown at left

RADIANT GAS BURNERS *create high-temperature* tin-coat fusing zone

BRIGHT FINISHING was the problem—and engineers of Crown Cork and Seal Company, Inc., Baltimore, adopted a high-temperature method for fusing tin to low-carbon strip, with resultant high-polish surface, in a continuous production mill.

Then, to obtain the high temperatures necessary for heat-processing, these engineers selected GAS and modern Gas Equipment. By directing the heat of radiant GAS burners over a concentrated area of the freshly-plated strip it was readily possible to coordinate the fusing action with the plating process to accomplish continuous high-speed production of bright finished strip.

This typical installation demonstrates the flexibility of GAS and the applicability of modern Gas Equipment for continuous, production-line heat processing. Compared with available fuels GAS is most readily controlled by simple automatic devices; Gas Equipment can be adapted for use with existing machinery or incorporated in new machinery without radical design changes, or expensive supplemental apparatus.

Manufacturers of Gas Equipment and the American Gas Association support continuing programs of research designed to assure the most efficient use of GAS for every heat-processing requirement.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

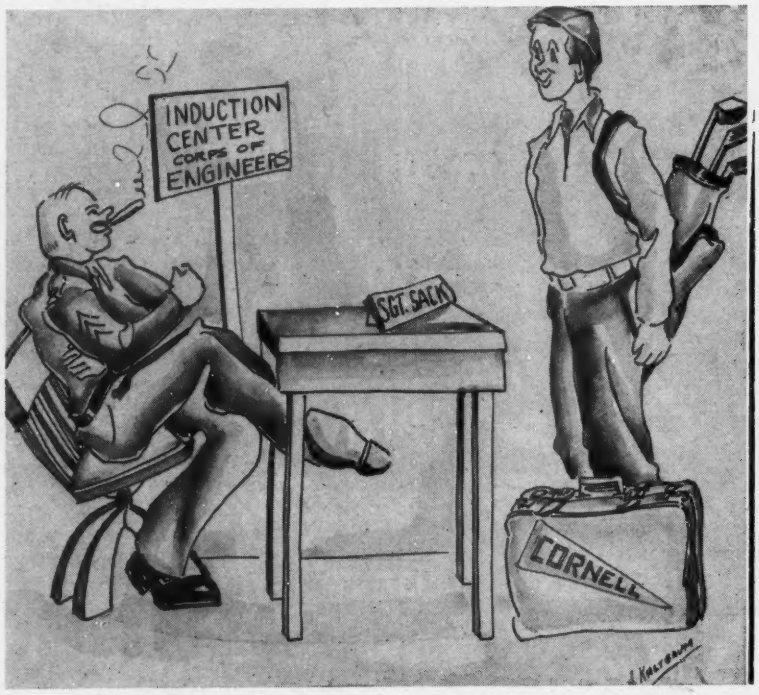
STRESS and STRAIN...

Old Lady: "Dear me, what were those Engineers arrested for down at the Stewart Avenue cemetery?"

Cop: "I caught them replacing the 'No Trespassing' signs with 'Happiness in Every Box' advertisements."

Boy: "May I have a quarter to go to the circus?"

Father: "I let you see the eclipse last week, do you want your life to be one perpetual round of gaiety?"



"That's right, son — this is where you register for engineering ! ! "

"Ah wins."

"What you got?"

"Three aces."

"No, yo don't. Ah does."

"What yo got, son?"

"Two eights and a razor."

"You sho do. How cum yo so lucky?"

* * *

Two small Negro boys were sitting on a curb. One turned to the other and asked, "Ah's five. How old is yo?"

"Ah doan know. Ah guess ah's five, too."

"Does yo dream of wimmen?"

"Nope."

"Yo's only foh!"

Tobacco is a filthy weed,
I like it.
It satisfies no normal need,
I like it.
It makes you thin, it makes you lean,
It takes the hair right off your bean,
It's the worst darn stuff I've ever seen,
I like it.

* * *

"Now," said the professor cheerfully, "Please pass all your papers to the side of the room and insert a carbon under each paper so that I can correct all the errors at once."

"Did you hear about the Scotchman who died of apoplexy?

"No, how did it happen?"

"He was throwing pennies to the kids from his window, and the string broke."

* * *

The little boy's watch had stopped ticking and he tried to find the trouble. Finally he took the back off it, went into the works, and found a dead bug. "No wonder it doesn't work," he said, "the engineer's dead."

* * *

A young Brooklyn soldier was on maneuvers in Oregon. Having a few minutes to himself after evening chow, he strolled out into the woods and soon came back with a handful of rattles from a rattlesnake.

"Where in the world did you get them?" gasped his alarmed companion.

"Off'n a woim," replied the lad from Brooklyn.

* * *

She: "And if I refuse, will you kill yourself?"

Sibley Engineer: "That is my usual custom."

* * *

The modern coed's lips are kissproof, her skin paint proof, and her breath about 86 proof.

* * *

"Still engaged to Maude?"

"No."

"Good—how did you get rid of her?"

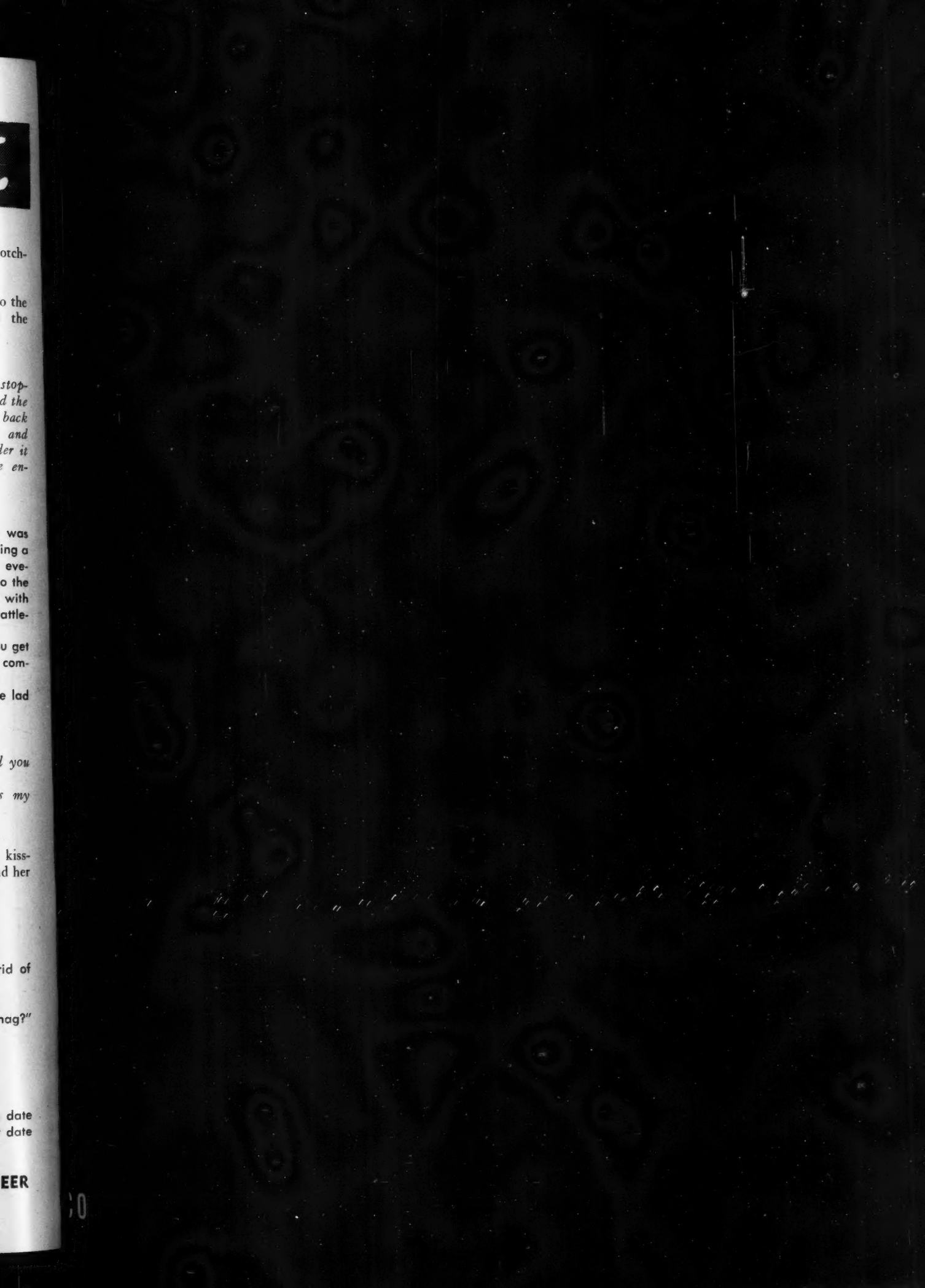
"What?"

"How'd you drop that old hag?"

"Who?"

"Maude!"

"I married her!"

* * *

The two biggest wolves to date are Chase and Sanborn—they date every bag.